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Vegetation Disturbance History of Great Smoky Mountains National Park: An Analysis of Archival Maps and Records

United States Department of the Interior

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VEGETATION DISTURBANCE HISTORY OF GREAT SMOKY MOUNTAINS NATIONAL PARK: AN ANALYSIS OF ARCHIVAL MAPS AND RECORDS

by Charlotte Pyle

NATIONAL PARK SERVICE - Southeast Region

Research/Resources Management Report SER-77

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ABSTRACT

The major prepark human disturbances in Great Smoky Mountains National Park (GRSM) were logging, farming activities, and fire. The primary objective of this project was to collate, in mapped form on a parkwide basis, vegetation disturbance history information from materials available in the GRSM Archives. Collation required careful map interpretation including a study of map makers' terminology and the effects of physical (map) scale, temporal scale, and map makers' scale of focus. Mappable disturbance history information was collated at the 1:24,000 scale on four map sets (available at Uplands Lab, GRSM): (1) buildings and cemeteries, (2) fire boundaries, (3) boundaries of disturbance other than fire, and (4) prepark roads, trails, and railroads. Evaluation of these map sets plus written information was used to develop disturbance categories suited to small scale maps. The disturbance categories included concentrated settlement, corporate logging, diffuse disturbance, herded livestock grazing, fire, and areas high in virgin forest attributes. The categories of "corporate logging," "diffuse disturbance," and "high in virgin forest attributes" were conceptually different from historic map makers' land use and vegetative type categories. Consequently, the results presented in this report did not resemble earlier maps, especially as to location and total area of "virgin forest." This report was also unique in that appendices with full documentation and evaluation of information sources used plus a glossary of map terminology were included.

ACKNOWLEDGEMENTS

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TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

INTRODUCTION

Management Perspective

The United States Congress' Yellowstone Act of 1872 established the first national park "for the preservation from injury or spoliation of all timber, mineral deposits, natural curiosities, or wonders . . . and their retention in their natural condition." Protection of specific physical or biotic elements, rather than preservation of ecosystems or natural processes, was the guiding philosophy of National Park Service (NPS) management throughout the nation until the early 1960's. At this time, the overpopulation crisis of the Yellowstone elk herd prompted a study by the U. S. Dept. of the Interior Advisory Board on Wildlife Management (Leopold, et al. 1963). Although the Leopold report addressed wildlife management, its conclusions were presented in a context that greatly influenced subsequent overall Park Service resource management policy. First, the report stated that the management goal of the National Park Service should be viewed not as protection of specific elements but as preservation (or re-creation) of "the ecologic scene as viewed by the first European visitors" (Leopold, et al. 1963). Second, recognition must be given to the fact that primitive America included successional vegetation communities "that were maintained by fires, floods, hurricanes, and other natural events" (Leopold, et al. 1963).

In order to manage for the pre-European landscape, the vegetative associations of that time must be known. In Great Smoky Mountains National Park (GRSM), pre-European conditions are not known to the degree that precise vegetation maps could be made. However, descriptions by early travellers and residents, both in the Great Smoky Mountains and the adjacent southern Appalachian mountains, do exist (Timberlake 1765, Buckley 1859, Olmsted 1860, Van Doren 1928, Guyot 1938, Brewer and Brewer 1975, McCracken 1978). Furthermore, recent research on native Americans (Dickens 1976, Goodwin 1977,) and analysis of pollen and charcoal deposits (Chapman, et al. 1982) provides clues as to the pre-European composition and successional stage of GRSM forests. Other hints about pre-European forest composition can be found in field examination of areas believed to be relatively unaffected by changes in disturbance regime following the arrival of European settlers.

Disturbance following the arrival of European settlement was an important factor in determining vegetation patterns in Great Smoky Mountains National Park. For example, at the time of the park establishment (1934), over half the total area of the park had been cut over by large corporately-owned logging companies. Pioneers had settled and farmed for some 100 years. Logging, farming, and other disturbances, both natural and anthropogenic (human caused), had set the patterns seen in the landscape in 1934.

Because much of the park's current vegetation is a result of relatively recent human disturbance, it is in a successional state, still changing in response to the conditions initiated by disturbance. Presence of changing vegetation has profound influence on how the landscape must be managed for the long run goal of presenting the scene as viewed by the first European visitors. It also has relevance to development of strategies for protection of rare and endangered flora and fauna whose critical habitat may indeed be successional vegetation types.

Project Scope and Objectives

The scope of this project was to produce a parkwide overview of vegetation disturbance history based upon analysis of existing archival records. Specific objectives were:

1. To collate the mappable anthropogenic disturbance history information available for fire, farming, and logging on a parkwide basis from the GRSM Archives; and

2. To review the contents of the GRSM Archives with respect to usefulness of available disturbance history materials.

Overview of GRSM Disturbance-Related Materials and Studies

Maps and information on some historic vegetation disturbances were available in the GRSM Archives. Table 1 lists the types of disturbances known in the park at the time of establishment. It does not include post-park establishment disturbances such as infestation by balsam woolly adelgids or possible declines in tree growth due to atmospheric pollution. The archival materials were primarily concerned with the most dramatic of the anthropogenic disturbances, namely logging, fire, and farming activites of European settlers. The information on the impacts of prepark Native Americans living in and around the Park prior to the arrival of white settlers cannot be mapped at scales relevant to this report and so were not included.

Although several disturbance studies have been done in GRSM, few researchers focused on documenting past disturbance at the parkwide level. In addition to the historic maps to be discussed in this report, parkwide overviews of disturbance include treatments of logging (Frome 1966, Lambert 1958), pioneer history (Lambert 1957), and fire (Harmon 1981). Lambert's works were by far the most detailed and meticulously researched, but they did not include maps. Harmon compiled map locations of disturbance by fire for the years 1940-1979 (Map 90; Pyle 1983a). He then analyzed the pattern of fire disturbance with respect to cause, topography, elevation, season, frequency, and size (Harmon 1981). Using a vegetation map based on fieldwork done 1935-1938 (Miller Map 56; Pyle 1983a) and Archival records, Pyle (1984) tabulated area of disturbed and undisturbed locales by major watershed in the spruce-fir zone.

Other disturbances have been studied in GRSM, but parkwide maps were not provided. Woods and Shanks (1957, 1959) and later Arends (1981) studied changes in forest cover type following chestnut blight. McCracken (1978) studied forest regeneration following mechanized logging. Kuykendall (1978) documented forest response to southern pine beetle infestations during a recent outbreak. Studies have been made on vegetation change following cessation of grazing on grassy balds (which was ongoing until about the time of park establishment). For example, Bruhn (1964) studied the rate of encroachment of woody plants on three grassy balds in GRSM. Lindsay and Bratton (1979) included a short review of grassy bald literature in their report on high elevation disturbed areas in GRSM. Other researchers have compared data from disturbed versus undisturbed forests in GRSM. For example Silsbee and Larson (1983) compared physical, chemical, and bacteriological characteristics of two streams, one in unlogged forest and the other in a logged and burned area.

TABLE 1. A CATALOGUE OF DISTURBANCES KNOWN TO HAVE OCCURRED IN GREAT SMOKY MOUNTAINS NATIONAL PARK PRIOR TO 1934. Note that this report itself is concerned only with mappable disturbances due to logging, farming, or fire.

LOGGING
- Mechanized
  - railroads
  - skidders
- Early style
  - draft animal powered
  - splash dams

FIRE
- Logging slash fires
- Fires of average low intensity
- Lightning caused fires
- Fires associated with farming activities to
  - -clear the forest understory
  - -promote grass and woody sprouts for livestock
  - -kill insect pests
  - -expose fallen chestnuts
  - -aid in blueberry reproduction
- Native American caused

MISCELLANEOUS INDUSTRY
- Charcoal production
- Turpentine production
- Tanbark gathering
- Quarries and mines
  - slate
  - limestone
  - flint
  - saltpeter
  - iron
  - copper

FARMING ACTIVITIES
- Plowing
- Cleared pasture
- Woods pasture (fenced or unfenced)
  - hogs
  - cattle
- Orchards
- Hay production
- Firewood
- Fence rails
- Gathering
  - chestnuts
  - blueberries

BIOTIC ELEMENTS
- Southern pine beetle
- Chestnut blight
- Endemic insects and fungi

PHYSICAL ELEMENTS
- Wind
- Ice
- Landslides

The present work is unique in that it combines mapping with interpretation of anthropogenic disturbance patterns on a parkwide level. Prior to preparing this report, I had summarized my findings on the meaning and usefulness of disturbance-related information sources (maps, written materials, and air photos) available in the GRSM Archives (Pyle 1983a, 1983b).

METHODS

Description of Information Sources.

I searched the GRSM Archives for maps and easily accessible records concerning prepark land use. At the outset, all maps filed under "vegetation," "lumbering," or "fire" were examined and indexed. Miscellaneous maps located later were also indexed. The index procedure has been described and copies of the completed index forms are on file at Uplands Laboratory, GRSM (Pyle 1983a). Because many maps in the GRSM Archives were untitled, throughout this report maps may be referred to by index number. Maps appearing to have potential for use in disturbance history work were further evaluated. Individual map evaluation forms will not be presented in this report as they were included in Pyle 1983a. However, Appendix A contains a description and evaluation of the important information sources.

I used easily accessible records such as research reports to the Park Superintendent (Lambert 1957,1958). In addition, I examined Lambert's notes as well as boxes of archival records, sorted by lumber company, for information on broad scale logging patterns. I did not examine other archival records such as files on persons or organizations concerned with park establishment. I spent little time on the available aerial photographs, as their interpretation required ground truthing on a scale that was beyond the scope of this project.

Collation of Map Information.

Map information was collated in two forms: (1) at the 1:24,000 scale (for which there were 26 single maps in a parkwide set of maps), and (2) at a broad overview scale of about 1:386,000, on which the entire park was depicted on an 8-1/2" x 11" page.

1:24,000 scale-map sets. The 1:24,000 scale (7.5 minute topographic quadrangle) map sets are not included in this report. However, Appendix B gives a detailed discussion of the sources of information and mapping codes used. In brief, four parkwide sets of 1:24,000 scale maps were prepared to show location of (1) prepark buildings and cemeteries, (2) fire boundaries, (3) boundaries of prepark disturbance other than fire, and (4) prepark roads, trails and railroads. Preparation of the map sets showing buildings and cemeteries, fires and roads, trails and railroads was straightforward in that most of it was already on 1:24,000 scale maps and there was little conflicting information in the available GRSM archival materials. Therefore, the information was merely collated into the appropriate map set.

In contrast, the collation and transfer of map information on disturbance boundaries other than fire was not straightforward. Many maps

were available at differing scales and contained apparently conflicting information. Therefore the methodology employed to collate disturbance boundary information was as follows:

1. Transfer information from scales other than 1:24,000 to 1:24,000 scale overlays of U.S.G.S. 7-1/2 minute topographic sheets.
2. Compare the overlays to pinpoint locations of conflicting information.
3. Analyze the conflicts.
4. Develop a conceptual model to evaluate the maps in terms of their reliability and content.
5. Following evaluation, collate pertinent information onto the 1:24,000 scale map set.

I used a Kargl Reflecting Projector (Keuffel and Esser Co., U.S.A.) to transfer information from base maps of 1:62,500 or 1:63,360 scale. Transfer from 1:125,000 scale was done by unaided eye. Both transfer methods involved imprecision due to topographic or projection differences between old and new map representations and to distortion inherent in the projector.

Aside from the difficulties caused by map distortion, most conflicts in the overlay information were resolved either through the use of the concept of focal scale (discussed below) or by clarification of map terminology through reference to written records and information from map makers who are still living. Appendix C provides an annotated glossary of terms found on GRSM archival maps and terms developed for presentation of the results of this study.

The concept of focal scale may be contrasted with map scale. Map scale refers to the representative fraction, which may be large scale (e.g., 1:24,000) or small scale (e.g., 1:125,000). Focal scale, as used in this report, refers to the scale at which one focuses thought. For example, farming can be viewed in terms of broad scale patterns (e.g., location of clusters of farms) or in fine scale detail (e.g., location of garden vegetables versus corn fields). While it is clear that a small scale map (e.g., 1:375,000) cannot be expected to show great detail, use of a larger scale map (e.g., 1:24,000) does not necessarily imply presentation of a larger amount of detail. Recognition of the implications of the concept of focal scale was important to my interpretation of the reliability and content of the available historic maps.

Because the bulk of this study was limited to archival records, the accuracy of the archival maps could not be evaluated through fieldwork. Therefore, I worked under the assumption that if information on disturbances with discrete boundaries (ref. Appendix C) was repeatedly plotted in the same map location by people believed to have worked independently of each other, then those maps were likely accurate. Inclusion of information on the final map set was, therefore, determined by uniqueness of information, degree of detail, clarity of original map maker's intent, and presumed accuracy of the work.

Broad Overview Scale Maps The eight small scale maps presented in the Results Section (Figures 1-8) were derived primarily from summarization of the information shown on the large scale map sets discussed above. In addition, written information and field observations were taken into account. Based on the conceptual model developed for evaluating the maps used in the 1:24,000 scale "Boundaries" map set, Figures 1-8 were drafted to show a spectrum of disturbance patterns ranging from intense, clearly recognizable disturbances through disturbances increasingly diffused within the landscape to areas with little or no record of prepark disturbance. The boundaries of intensive disturbance were transferred to Figures 1-8 by tracing reduced xeroxes of a Land Use Map made by R. P. White and G. K. Preston and the Wilderness Overlay made by Frank Miller. (These maps have been numbered 51 and 38, respectively, on the Uplands Laboratory Map Index given in Pyle 1983a. Citations for maps to be discussed herein are given by map number at the end of this report. For reference as to map storage location and content, consult Pyle 1983a.) On Figures 2-8, boundaries of diffuse disturbance were based on written records and field observations. Written and mapped records of logging and fire were used in Figures 6 and 7. And areas with no record of disturbance were mapped as "high in virgin forest attributes" in Figure 8. In Appendix D, the source of information for each boundary shown on Figures 1-8 is documented.

Area Estimates of "Virgin" Forest.

In preparing the discussion of different map makers' concepts of "virgin" forest, I used a planimeter or dot grid to estimate areas mapped as "virgin." Estimated areas based on planimeter measurement were the average of three measurements, while dot grid area estimates were the average of two dot counts. Tracings of some maps (Maps 38, 50, 72, 76) were required for planimeter area estimates because the original maps were too wrinkled or fragile to be used directly. On Figure 8 and the small disjunct "virgin" areas of Maps 38 and 50, a dot grid was used to estimate area. Because map scale as well as the total area of the park changed from map to map, I standardized virgin forest area estimates for each map relative to the area encompassed on that map by the Big Creek watershed which had constant boundaries from map to map. I derived the proportional area of Big Creek versus the entire park from an unpublished National Park Service Denver Service Center map of major Park watersheds labelled with acreages (Map 98; Pyle 1983a).

RESULTS

The Usefulness of Written Records in the GRSM Archives

In general, the written records in the Archives are not easily accessible in terms of finding disturbance history information that can be mapped at the 1:24,000 scale. The written records most useful to disturbance history work are the lumber company records; condemnation proceedings; land title abstracts; microfilm U. S. Census records (1850-1880); Lambert's notes; and cemetery burial records. The cemetery burial records might serve as a source of information on names of people who lived in an area and the dates of occupation by settlers.

The lumber company records contain few maps, and are generally limited to business transactions, timber tallies of cruises (not done in a

repeatable manner), and mill records lacking information on the sources of timber. Occasionally, information that may be valuable on a site-specific basis is present. The records of the Aluminum Company of America and the Little River and Montvale Lumber Companies appear to be the most likely candidates for future use.

The lumber company files sometimes contain materials associated with park condemnation proceedings. These may yield descriptions of the severity of disturbance that occurred within the general boundaries of a lumber company's domain. Sometimes they include information on acres cut or board feet removed from a given watershed. Less frequently, they have information mappable at a finer scale. Because the condemnation proceedings led to a decision on the sale price of a tract, both the park advocates and the lumber companies were prone to rhetoric and exaggeration when presenting their cases.

Lambert's notes, which both document his sources (for Lambert, 1957; 1958) and provide additional information, are filed in the GRSM Archives. Lambert's notes represent a distillation of lengthy written materials, primarily the lumber company files and condemnation proceedings described above. In addition, Lambert included excerpts from his interviews with loggers and other persons familiar with prepark conditions. Some of the interviews were taped. These are available for listening at the GRSM Archives.

Lambert (1957) used the U.S. Census records of population and agricultural schedules in conjunction with the land title abstracts to get a picture of pioneer life in the park during the years 1850-1880. Although the Park Archives does not have any later Census records, they have been released for public use from Federal storage up to the year 1910. At present the park has an incomplete set of title abstracts for the Tennessee side, so Lambert's methodology is less workable in Tennessee. Other pitfalls in this technique include the fact that many people had the same first and last name in the Great Smoky Mountains. In addition, some people connected the census to taxation and withheld information concerning the extent of their farm's productivity and the number of their free-ranging livestock.

Anthropogenic Disturbance Patterns in GRSM.

This portion of the results section centers around the eight overview maps (Figures 1-8). These small scale maps present generalized patterns of disturbance rather than intricate detail suited to larger scale maps. Beginning with a division of prepark disturbance into two categories (areas affected by corporate logging and areas of concentrated settlement), Figures 1-8 grow increasingly complex due to four factors: (1) expansion of the concept of disturbance to include not only concentrated disturbance but also disturbance diffused throughout the landscape, (2) addition of disturbance categories, (3) subdivision of logged areas to reflect severity of disturbance, and (4) overlay of disturbance by fire. Note that Figures 1-5 are a cumulative series; that is, each map repeats information from the previous map.

General description of disturbance due to logging and farming activities (Figure 1). The major prepark anthropogenic disturbances were large scale logging and farming activities. I have defined farming activities to include activities which contributed to farmers making a livelihood in the prepark Great Smoky Mountains. These activities involved cleared fields, cleared pastures, woods pasture, orchards, intentional fire setting, and gathering of forest products for home use or as a family cash crop (e.g., chestnuts, blueberries, firewood, fence rails, tan bark, lumber).

Gathering of forest products such as tan bark and trees to be made into lumber was done on a corporate scale as well as by individuals. The easily accessible GRSM archival information is not detailed enough to separate the case of selective logging in a cove by a farmer who cut and sold a few trees per year from the case of the farmer who allowed local or outside timber operators to go in and cut all the commercially profitable trees at once. However, either of the above situations are easily separated from large scale commercial enterprises financed by outside corporate interests. Corporate logging involved large tracts of land, use of mechanized equipment, and, generally, harvest of a wider range of sizes and species than did small scale logging. Lambert (1958) used the term "early logging" to refer to the small scale logging that took place before the advent of railroads and mechanized skidders and loaders, which arrived in GRSM around the turn of the 20th century. I use the term "early style logging" to mean small scale logging that, for the most part, employed draft animal or water power rather than mechanized equipment. After the arrival of corporate lumber companies, early style logging continued in low elevation drainages of the park in Tennessee, especially east of Gatlinburg. There, a mosaic of individual landholdings prevented the corporate loggers from acquiring the large tracts necessary for profitable mechanized logging. The reason for the greater prevalence of corporate logging in North Carolina was the higher degree to which large low elevation tracts had remained in the hands of land speculators rather than having been parcelled out to settlers.

Although farming activities and corporate logging took place in both North Carolina and Tennessee, the preponderance of small landholdings at lower elevations in Tennessee resulted in farming activities and early style logging prevailing over corporate land use to a small degree, while corporate logging was the dominant prepark land use in North Carolina.

Diffuse disturbance closely associated with settled areas (Figure 2). In farmed areas, increased distance from areas of heavy settlement led to a dominance of diffused rather than discretely mappable disturbance. While areas of heavy settlement may have included tracts that were commercially cut in the early logging style, such cutting is more likely to be found in outlying areas of heavy settlement. Of course, the location of outlying areas is time frame dependent because as settlements grew, the outlying areas became settled. In such cases, disturbance to the outlying area would be incremental; that is, effects of early logging would be covered by subsequent cultivation or pasturing. Besides early style logging, the major disturbances in outlying areas were intentionally set fires and livestock grazing. Grazing, as used here, should be interpreted to include not only cattle and other grazers utilizing "woods pasture," but also

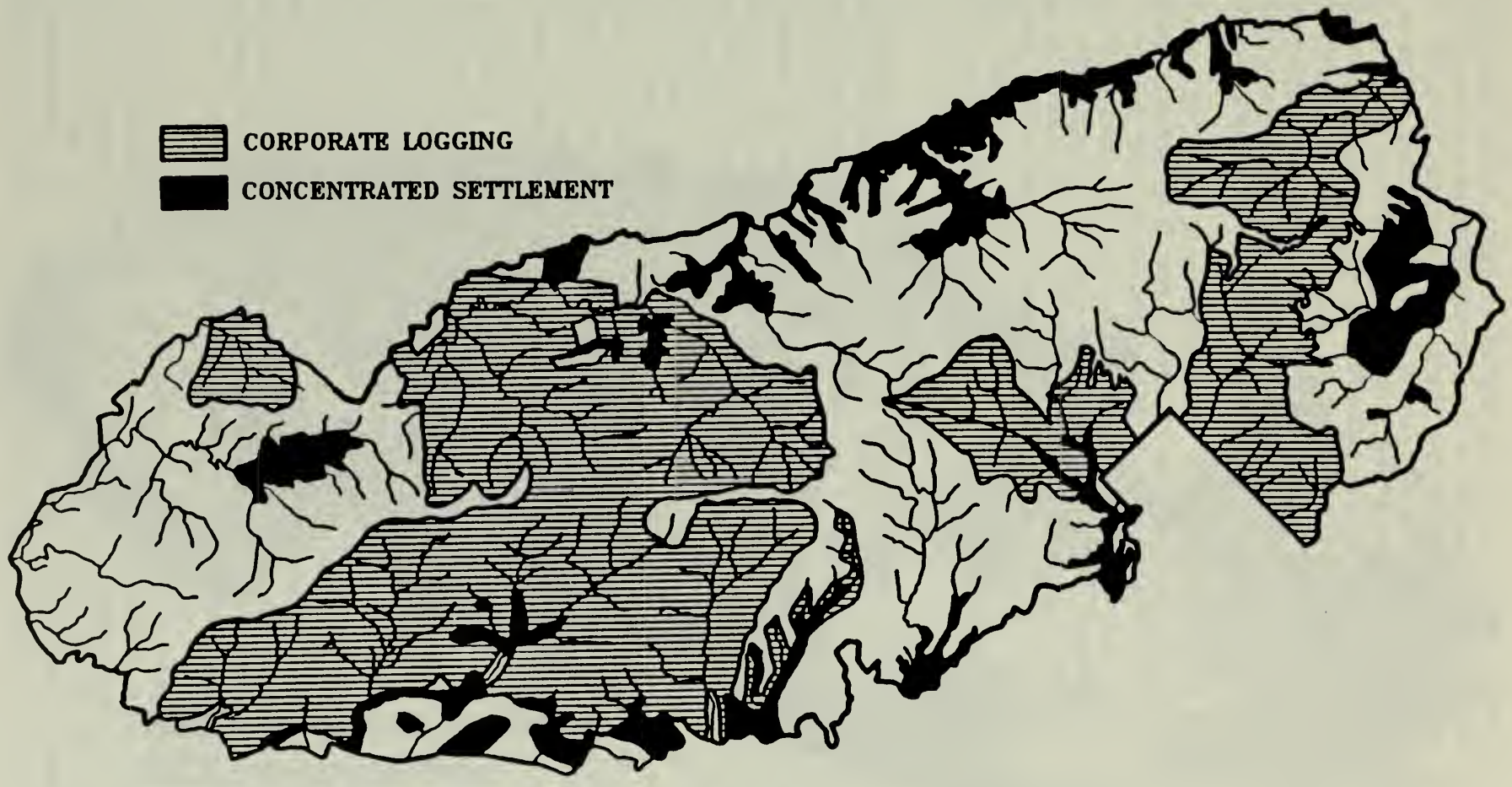

Figure 1. General description of disturbance due to pre-GRSM logging and farming activities.

Figure 2. Diffuse disturbance closely associated with settled areas of GRSM prior to park establishment in 1934.

domestic hogs turned loose to forage roots, fall mast crops, and other food items. It was a common practice in the Southern Appalachians to turn cattle loose in logged areas. Early writers (Ayres and Ashe 1905, Holmes 1911) remarked upon the lack of forest regeneration in these areas. The extent to which cattle grazing and intentionally set surface fires prevented regeneration and even further opened the canopy of early style logged forests in GRSM is open to debate. However, the pattern of anthropogenic disturbance in the Great Smoky Mountains at the time of park land acquisition was such that at least some effects of diffused disturbance can be recognized in outlying areas of heavy settlement.

Except for a study in Cades Cove (Bratton 1980), the effects of livestock grazing on forest dynamics have not been widely documented in GRSM. Neither has there been an effort to separate out the effects of tree removal done over an extended period of time by an individual versus tree removal done during a single early logging style operation. Therefore, tree cutting and early style logging are best presented together with the dispersed activities of farming (e.g., tree cutting, fires, livestock grazing, etc.). In Figure 2, concentrated settlement and corporately logged areas are contrasted with areas of interspersed farming activities and early style logging.

Areas of big trees and diffuse human activity (Figure 3).
Various unsettled areas in GRSM have no record of corporate logging. Although they support some stands of big trees, they are lacking in a wholly undisturbed appearance. This can be attributed in a general way to disturbance diffused throughout the area. One important disturbance for which little precisely mappable information was available was the occurrence of chestnut blight. Since chestnut blight killed over 99 percent of the mature chestnut trees in the park, areas where chestnut was once important have a disturbed appearance. To document former presence of chestnut trees on an individual plot basis, one might attempt to obtain information from Miller's 1935-38 plot records (located in the GRSM Archives) or the plot inventories of Woods and Shanks (1957 1959). Although neither of these sets of plots were originally permanently marked, some have since been located, remeasured, and marked (Arends 1981). On a small scale overview, Miller's mapped oak-chestnut vegetation provides a good reference to the location and relative importance of the oak-chestnut type in the park. Information with one copy of the Miller Map (Map 57; Pyle 1983a) shows 159,165 acres of oak-chestnut vegetation out of a total of 507,139 acres (=31 per cent oak-chestnut type total). Chestnuts were found in every forest type in the park except beech gaps and the spruce-fir zone. On Miller's park vegetation map, the oak-chestnut type was most prevalent in North Carolina. However, in the majority of the oak-chestnut forests in North Carolina, corporate logging created a greater disturbance in the landscape than did chestnut blight. Thus the appearance of disturbance in these previously logged oak-chestnut forests is not so easily attributed to chestnut blight as it is in unlogged areas.

In Cataloochee, North Carolina, chestnut blight was one of several diffuse disturbances in areas of big trees. The other disturbances were related to farming or early style logging. For Deep Creek, I could find no records (other than for chestnut blight) of diffused disturbance in the upper watershed. Deep Creek once had a high proportion of chestnut (Condemnation records: "Champion Fibre History, Expect to Prove", located

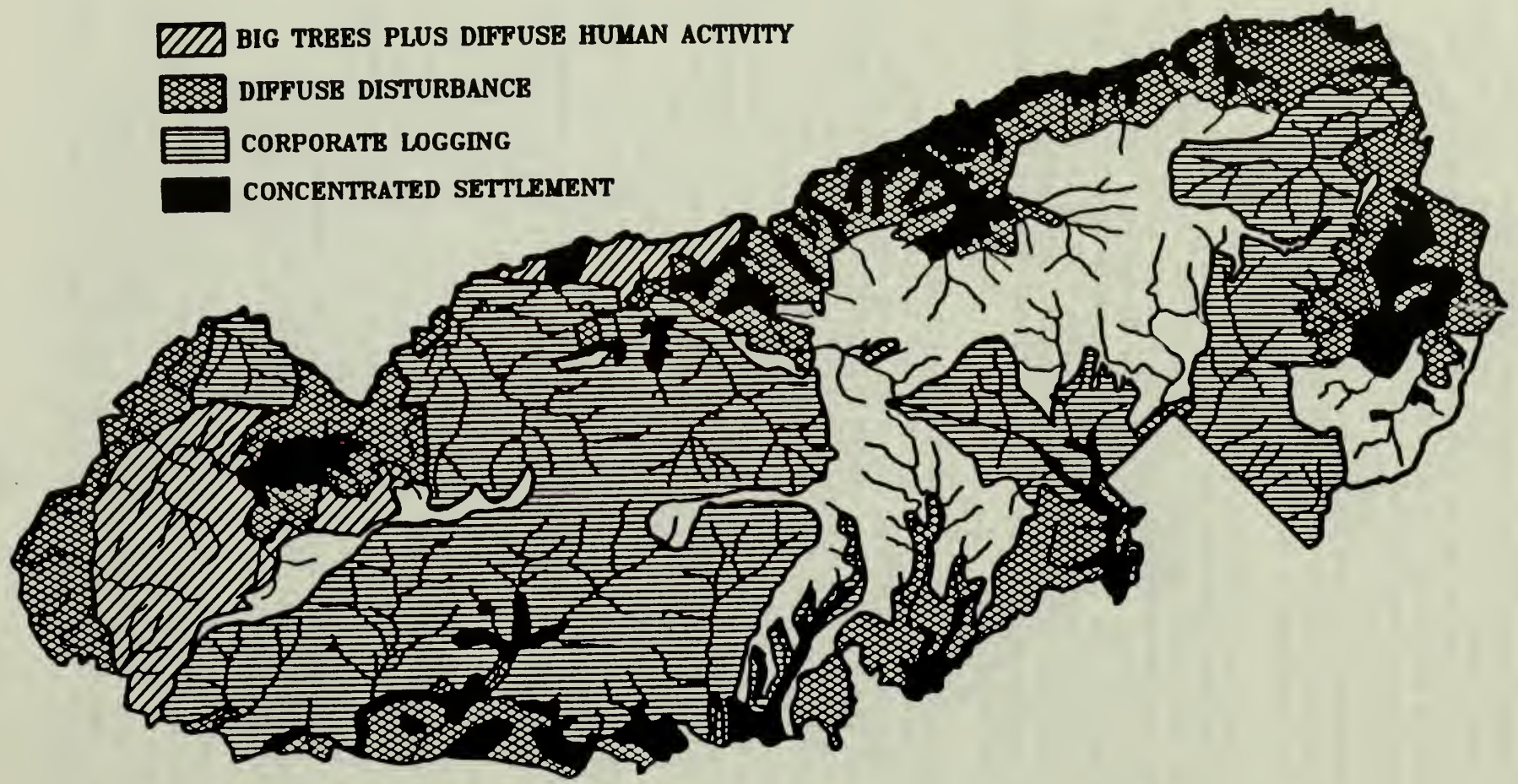

Figure 3. Areas of big trees and diffuse human activity.

in the GRSM Archives, Champion Fibre Company Records Box V-3). I attribute the current appearance of the hardwood forests in the upper elevations of Deep Creek to chestnut blight rather than past diffuse human activity.

In Tennessee, two areas with no records of commercial logging nonetheless appear partially disturbed. The high prevalence of yellow pines (which require open conditions and mineral soil for regeneration) in the area west of Cades Cove and along Cove Mountain on the park boundary suggests frequent fire. Anthropogenic burning is indicated because the extent of mature pine in these sections of GRSM requires, among other factors, a fire frequency greater than that caused naturally by lightning (Harmon 1981). Whether specific fires were set to open the woods for travel of people and livestock, to promote blueberries or grass growth, to kill insects and snakes, to expose fallen chestnuts, or some other reason is not known. Nor is the occurrence, location, and extent of other diffuse disturbances well known. Chestnut blight, while undoubtedly a factor, may have been less important in contributing to the disturbed appearance diffused throughout these two areas because of the prevalence of pine forests rather than oak-chestnut, especially on west and south facing ridges.

The aforementioned areas of diffuse disturbance, Cataloochee, Deep Creek, the west end of the park, and Cove Mountain, were shown as "virgin" on a map made in the early 1930's (Map 50). However, "virgin" on this map referred to areas that the then current corporate owners had not logged. For this reason, early style logging by a locally based company at low elevations in the Deep Creek watershed was discounted. Likewise, intentional fire and any other disturbances, such as farming, early style logging or small forest industries throughout Cataloochee, the west end, or Cove Mountain, were passed over. While categorization in this report of areas of "big trees plus diffuse human activity" takes into account presence of these disturbances, it does not preclude inclusion of valid stands of forest high in virgin attributes. In fact, such stands are known to exist and are expected within areas I have mapped as "big trees plus diffuse human activity" (Figure 3). Even in mapped areas of "diffuse disturbance" (Figure 2), occasional stands high in virgin forest attributes may be found.

Areas of suspected diffuse disturbance (Figure 4). This designation was used for areas believed not to be high in virgin attributes where the type and extent of disturbance was not well documented (see Appendix D).

Grazing (Figure 5). Diffuse disturbance due to "woods pasturing" (grazing of domestic livestock in a forested area) was probably important throughout the noncorporately logged lower elevations of the park. In addition, it is well known that cattle and sheep were driven up the mountains to the crest of the Great Smoky Mountains, where they were herded between grassy balds along the Tennessee/North Carolina border. Not all the routes livestock drovers used to get to the crest zone are well known. It is known that cattle were driven up out of Cades Cove (Lindsay 1976). Erosion patterns in an otherwise undisturbed area on Gregory Ridge indicate passage of a large number of animals (Dwight McCarter, personal communication). Figure 5 shows known areas of herded livestock grazing. These areas should not be interpreted to be the only areas in the park where herded livestock grazing was important. For example, there is reason

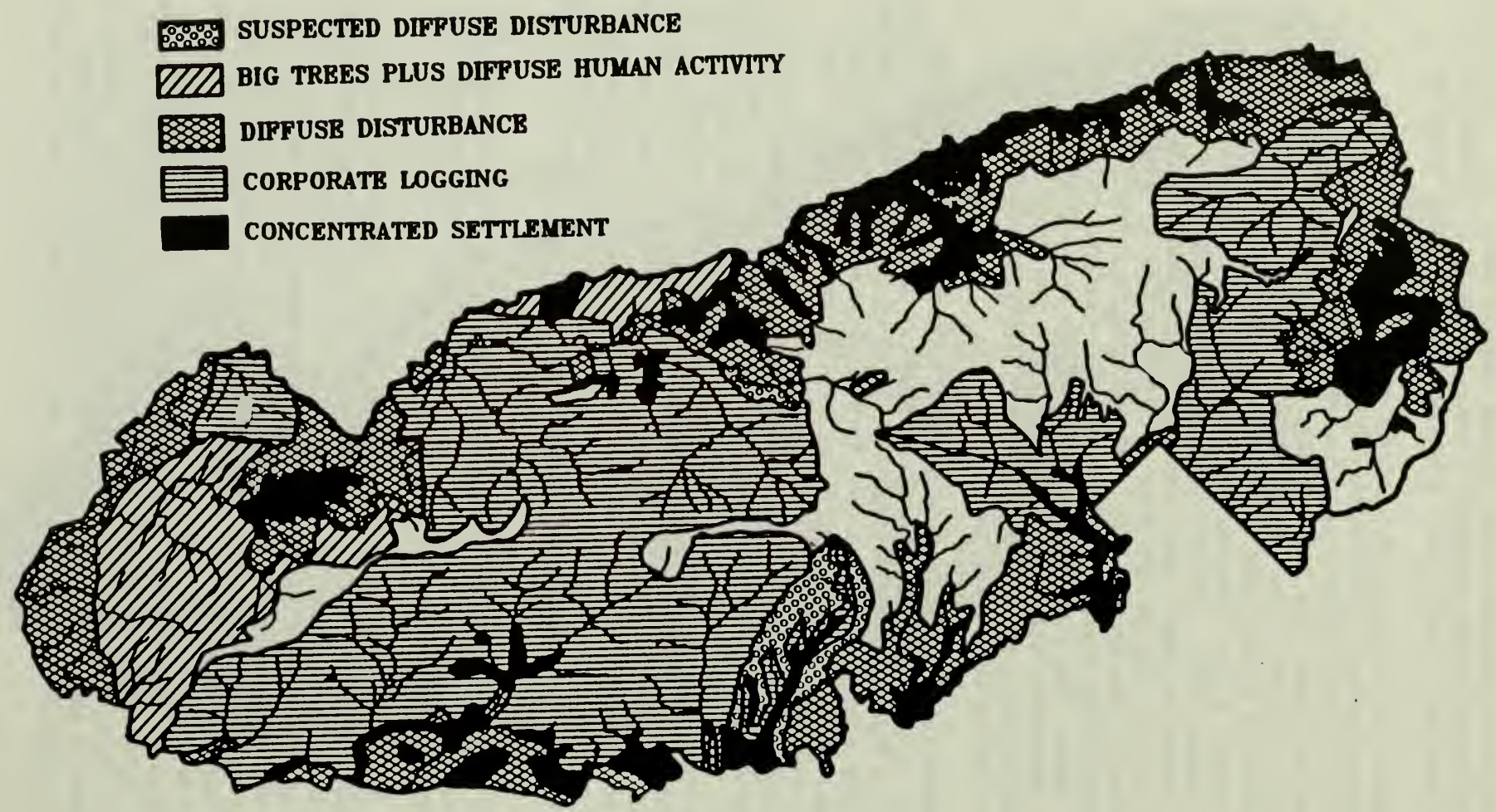

Figure 4. Areas of suspected diffuse disturbance.

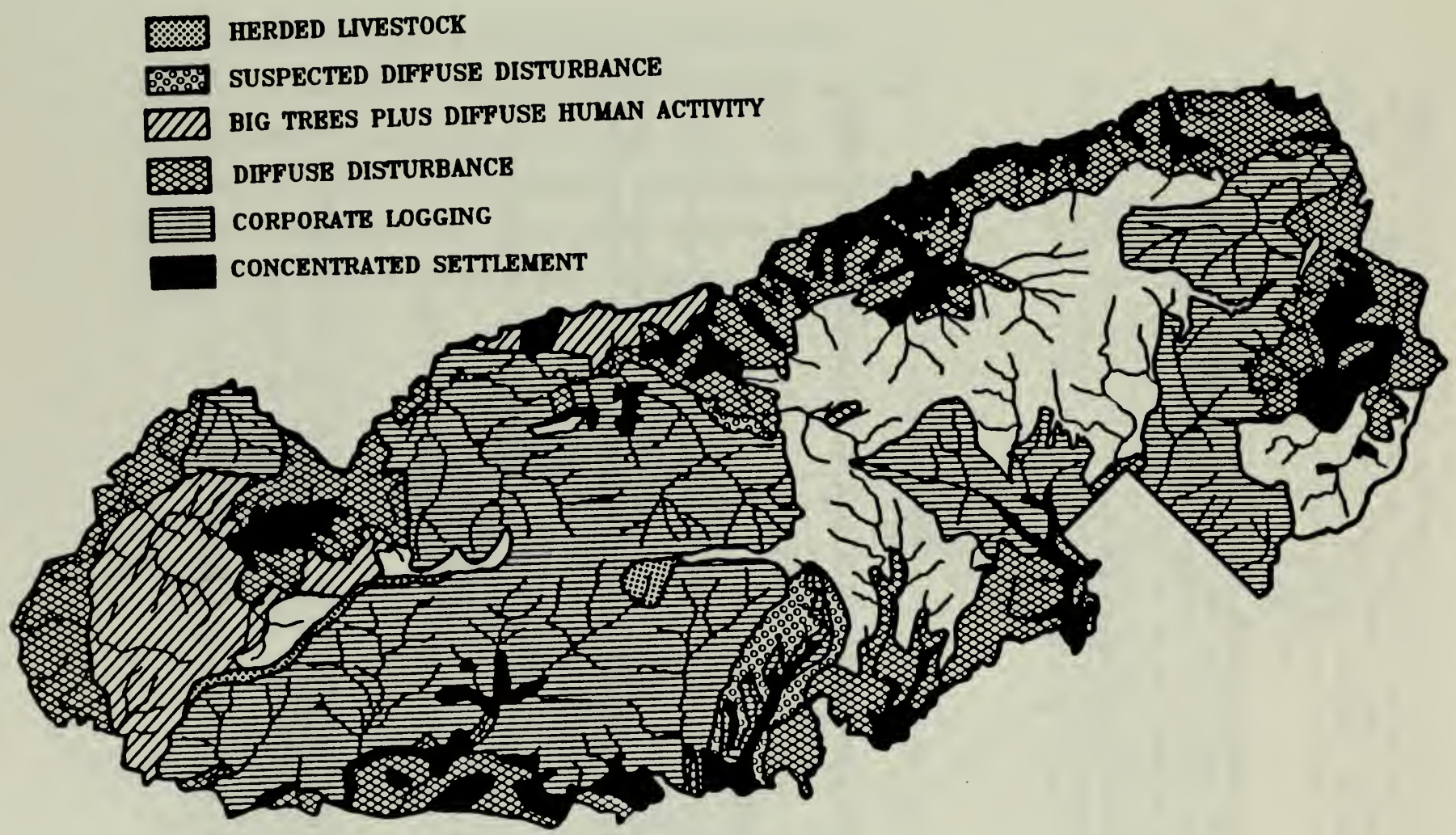

Figure 5. Areas of herded livestock grazing.

to believe that cattle were driven to high elevation pastures up Shanty Branch out of Cataloochee (Ed Trout, personal communication). Further, Stratton and White (1982) listed other grassy balds in the park. In addition, based on location of early travel routes, I suspect that cattle were driven up from the Little Tennessee River into the west end of the park.

Corporate logging (Figure 6). Corporate logging did not result in disturbances of equal extent and severity throughout the park. Factors involved in the effects of corporate logging include degree of mechanization, selectivity of cut, and physical extent, within a watershed, of a given logging operation. I used these factors as the basis of a classification scheme for evaluating corporate logging effects in the park (Table 2). Evaluation of corporate logging effects was done at the major watershed (i.e., a broad overview) level (Table 3).

TABLE 2. Factors Used in Rating Effects of Logging in GRSM Watersheds

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Degree of mechanization

1 = Little mechanized: railroad or tramroad into the area, but skidding and loading not known to be mechanized
2 = Somewhat mechanized: railroad plus limited mechanized skidding
3 = Greatly mechanized: railroad plus extensive mechanized skidding

Selectivity

1 = Highly selective: 1 or 2 species taken, large, defect-free trees only
2 = Somewhat selective
3 = Non-selective: many species and/or sizes taken

Extent

1 = Little extensive: logging generally limited to creeks
2 = Fairly extensive: slopes and creeks cut
3 = Highly extensive: extensive cutting on slopes

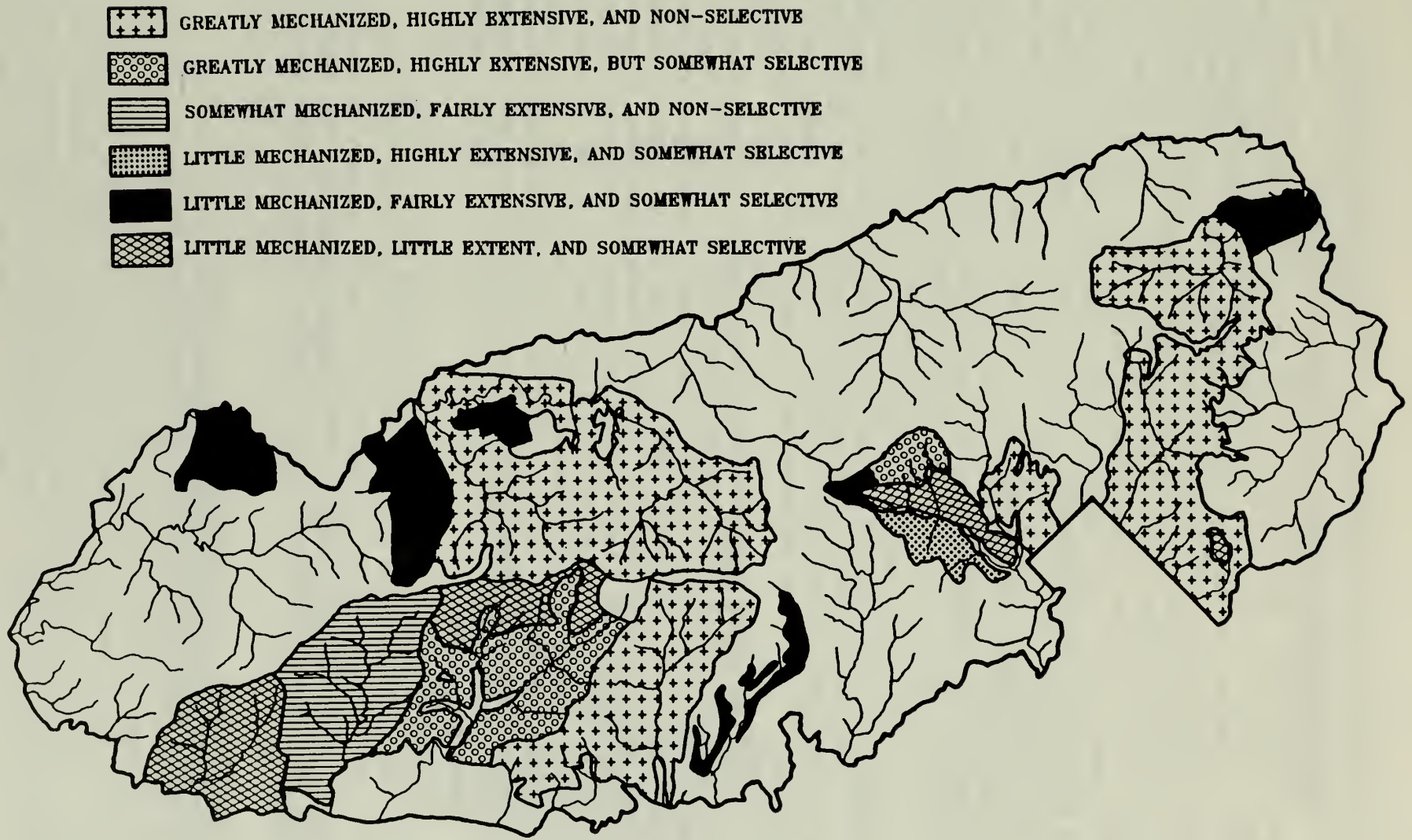

Figure 6. Corporate logging in GRSM.

TABLE 3. Rating of Degree of Severity of Logging in GRSM

Watershed	Degree of Mechanization	Extent	Selectivity
TENNESSEE			
East Prong of the Little River (Elkmont area)	3*	3*	3*
Middle Prong of the Little River (Tremont area)	3*	3*	3*
West Prong of the Little River	1*	0-2**	2**
Hesse Creek	1***	2***	2***
NORTH CAROLINA			
Twentymile Creek	1*	0-1**	2*
Eagle Creek	2*	2**	3*
Hazel Creek	0-3**	0-3**	0-2**
headwaters, Hazel Creek	0-1**	0-1**	0-2**
Forney Creek	3*	3**	0-3**
Noland Creek	1*	0-2**	2*
Bradley Fork	3*	0-3**	0-3**
Straight Fork	3**	3**	3*
Upper Cataloochee	3**	3**	3**
Big Creek	3*	3*	3*
Oconaluftee River			
extreme headwaters	1 **	0-2**	0-2**
Kephart Prong, adjacent streams	3*	0-3**	0-2**
Kanati Fork	1*	0-3**	0-2**
Beech Flats Prong	1*	1*	2*
Collins Creek	1**	0-3**	0-2**

Numerical codes shown in Table 2. (For codes preceded by "0-" the rating was based on inference made from written records in the GRSM Archives.)

*Denotes information from Lambert (1958) or Lambert's notes.
**Information from written records in GRSM Archives
***Information from Dwight McCarter, GRSM Backcountry Patrol

I based my ratings in Table 3 on written materials, the most important of which were Lambert (1958) and Lambert's notes. Where a rating is "0" followed by a second number, the rating was based upon indirect information. In those cases I inferred a rating from sources that gave no direct assessment of mechanization, extent, or selectivity. For example, Collins Creek (in the Oconaluftee River watershed) is shown on both Map 38 and Map 50 (Pyle 1983a) as "heavy cut." Although there are no records of use of mechanized skidders, logging was followed by fire. This strongly suggests that logging had created brushy conditions (i.e., slash and sprouts) conducive to fire. Highly selective horse team logging limited to creeks would not have been likely to have caused these conditions. Nor would a selectively logged area have been mapped as "heavy cut." Lambert's (1958) description of logging in the Collins Creek watershed, relates that the best hardwoods were taken from the lower part of the creek and its ridges. Further, Grinnell and Holt (in a report dated 1916, and located in the Champion Fibre Company records in the GRSM Archives) mentioned that nearly half of the Collins Creek area was cut over by the Three M Lumber Company. However, the report also states that the whole area could be logged by team and slide (i.e., without mechanized means). Taken as a whole, the above information suggests that where logging occurred in Collins Creek it was extensive, even without mechanized means. Although Lambert mentions the "best hardwoods" were taken, if ridges were logged the selectivity was not extremely high. Therefore, I rated the logging in Collins Creek as little mechanized, but highly extensive, and somewhat selective (Table 3).

While Table 3 suggests that disturbance was uniform at the watershed level, this is not the case. The watershed level is merely the practical level on which to work, given the archives-based nature of this project. Therefore, these ratings are to be taken as averages of the sections of the watersheds for which there was archival information available. In an overall less severely logged watershed, such as Hesse Creek, there are small areas of more severe disturbance (shown as "heavy cut" on Map 38). Likewise, in a more severely logged watershed such as Eagle Creek, E. J. Rosser reported uncut timber on heads of creeks and other hard-to-reach places. (See Rosser's testimony in North Carolina vs. Montvale Lumber Company located in the GRSM Archives, Montvale Lumber Company records, folder 2.)

In Table 3 I have separated the Oconaluftee River watershed into subdrainages. The separate areas were logged at different times by different companies. Because the differing logging impacts were never obscured by a wide ranging, highly mechanized, nonselective logging operation, the records of differences in the severity of logging effects remain valid. In Figure 6, subdrainages of the Oconaluftee River are mapped according to their ratings in Table 3.

Occasionally, in other major watersheds there are small areas shown separately on Figure 6 which were not rated separately (e.g., in Straight Fork and Big Creek). These small, separately indicated areas are based on written records that appeared to apply to areas previous mapmakers mapped as differing in severity of logging effect. For example, by Lambert's record (Lambert 1958), portions of Flat Creek were horse logged. This correlates reasonably with an area shown as "virgin" on Map 38. Therefore, even though there was not enough information to rate Flat Creek separately as to selectivity and extent of logging, I did map it separately. In this

case and similar situations, the map legend used was based on the gist of the descriptive phrase from Table 4 that seemed most appropriate.

Table 4 lists phrases (derived from Table 2) that describe the varying impacts of corporate logging in GRSM based on the numerical ratings shown in Table 3. These descriptive phrases were used in the legend of Figure 6.

I found two further records of logging in the park not shown in Table 3. There was corporate logging of 144 acres in the Raven Fork watershed. This was too small an area to show on Figure 6. The logging was within the area shown as diffusely disturbed on Figure 2. Lambert (1958) mentions logging on Coopers Creek and Lands Creek, although he also notes that much of the land is not in the park. Lambert's notes mention that corporate logging did not go past an area on Coopers Creek where the ownership was in question. Although a Champion Fibre Company map (Map 2) shows the area as "cut over," I believe that corporate logging did not penetrate farther than the end of the old road up Coopers Creek, where a homesite lies just within the current Park boundary. That the entire area was shown as "cut over" is believable in the context of the area's lack of exploitative value due to the relative inaccessibility of any remaining timber and to the presence of farms whose occupants presumably followed the typical land use practices of cutting trees as needed and annually setting the woods afire.

TABLE 4. Derivation of Legend Used on Figure 6

Mechanization	Extent	Selectivity	Descriptive phrase
3	3	3	Greatly mechanized, highly extensive, and nonselective
3	3	2	Greatly mechanized, highly extensive, but somewhat selective
2	2	3	Somewhat mechanized, fairly extensive, and nonselective
1	1	2	Little mechanized, little extensive, and somewhat selective
1	2	2	Little mechanized, fairly extensive, and somewhat selective
1	3	2	Little mechanized, highly extensive, and somewhat selective

Fire (Figure 7). The pattern of disturbance by fire in the Great Smoky Mountains is twofold. Fires following corporate logging were generally intense. In contrast, most fires set by settlers were of low intensity. The boundaries of forest altered (in condition, age class, or species composition) by fire were mapped by Miller (Map 56) in the 1930's in conjunction with vegetation mapping. Frequently, what is shown as a generalized burned over area on other maps is shown by Miller as two or more fires side by side with a stream running between them. My interpretation of this pattern is that, in the riparian zone, the fire did not burn hot enough to kill trees or otherwise alter the vegetation in a manner that would result in obvious major vegetational differences in the years following.

On a broad scale, these high intensity fires are interesting, not only because of their effect but because of their size. Most of them followed the mechanized logging operations that resulted in clearcutting of large areas during the time period from about 1900 to 1939. Many fires of high intensity occurred in 1925, a severe drought year. Such fires are unlikely to recur because the park is now protected from logging operations. Nonetheless, the influence of this one-time disturbance created conditions that determined the vegetation pattern of large portions of the park today.

Small fires are of interest to people working on small site-specific projects (e.g., a one-tenth hectare plot). Mappable archival information does not include nonintense fires before 1931, nor does it include any fires after 1939 to which GRSM personnel did not respond. On a large scale (i.e., for small, site specific-needs), the mapped fire records should not be considered complete. If past occurrence of fire is an important variable at a site, the site should be field examined for evidence of fire.

The relationship of fire to other anthropogenic disturbance in GRSM can be seen in Figure 7. Only in a few cases is a discretely mappable fire the only known disturbance in an area. In general, intensive fire coincides with disturbance by logging, while the broad scale pattern of small nonintense fires is mostly associated with concentrated settlement and areas of diffuse disturbance.

Areas considered high in virgin forest attributes based upon presence of little or no record of prepark disturbance (Figure 8). The bulk of this area is a continuous block made up of the spruce-fir zone and hardwood and hemlock forest in the middle to upper elevations of the eastern half of the central portion of the park. There are outliers of spruce-fir and hemlock forests to the east and islands of hardwood forest in the western half of the park on the Tennessee side. Some of the maps in the park Archives showed "virgin" forest in North Carolina in accord with a pattern of logging throughout a watershed except for virgin forest on the Appalachian Trail and high ridgetops within the watershed. This pattern is a reasonable reflection of the decreasing intensity of logging as one gets further away from railroads located in the choice timber along creeks. However, these maps appeared to be drawn by rote rather than reason. For example, on Map 5 (Pyle 1983a) this same pattern was shown for Deep Creek, which was not corporately logged and consequently should be represented differently than the heavily disturbed corporately logged watersheds to the west. Furthermore, although not every merchantable tree was taken, limited field observations lead me to believe that these virgin ridgetops in

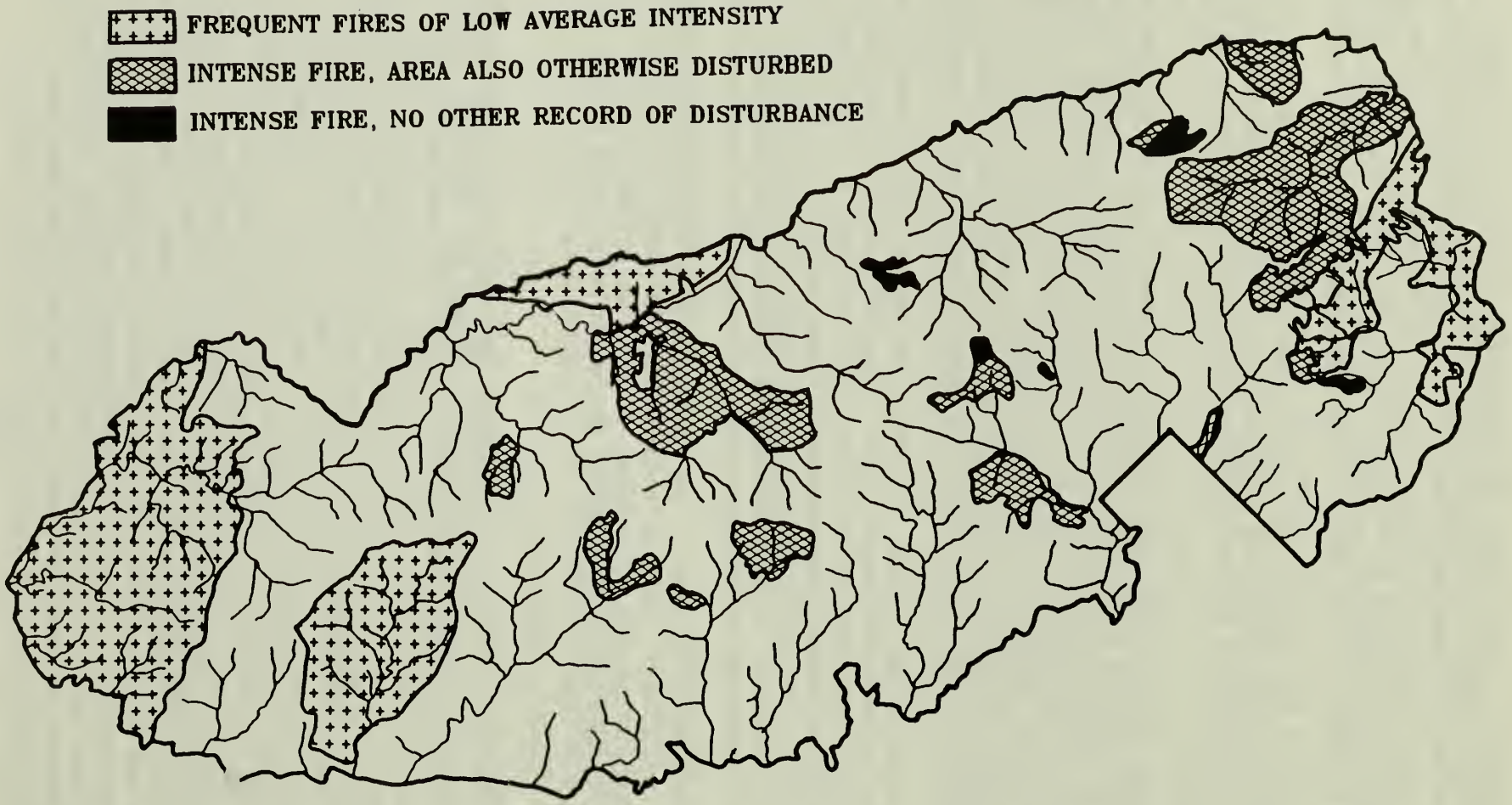

Figure 7. Record of prepark fires in GRSM.

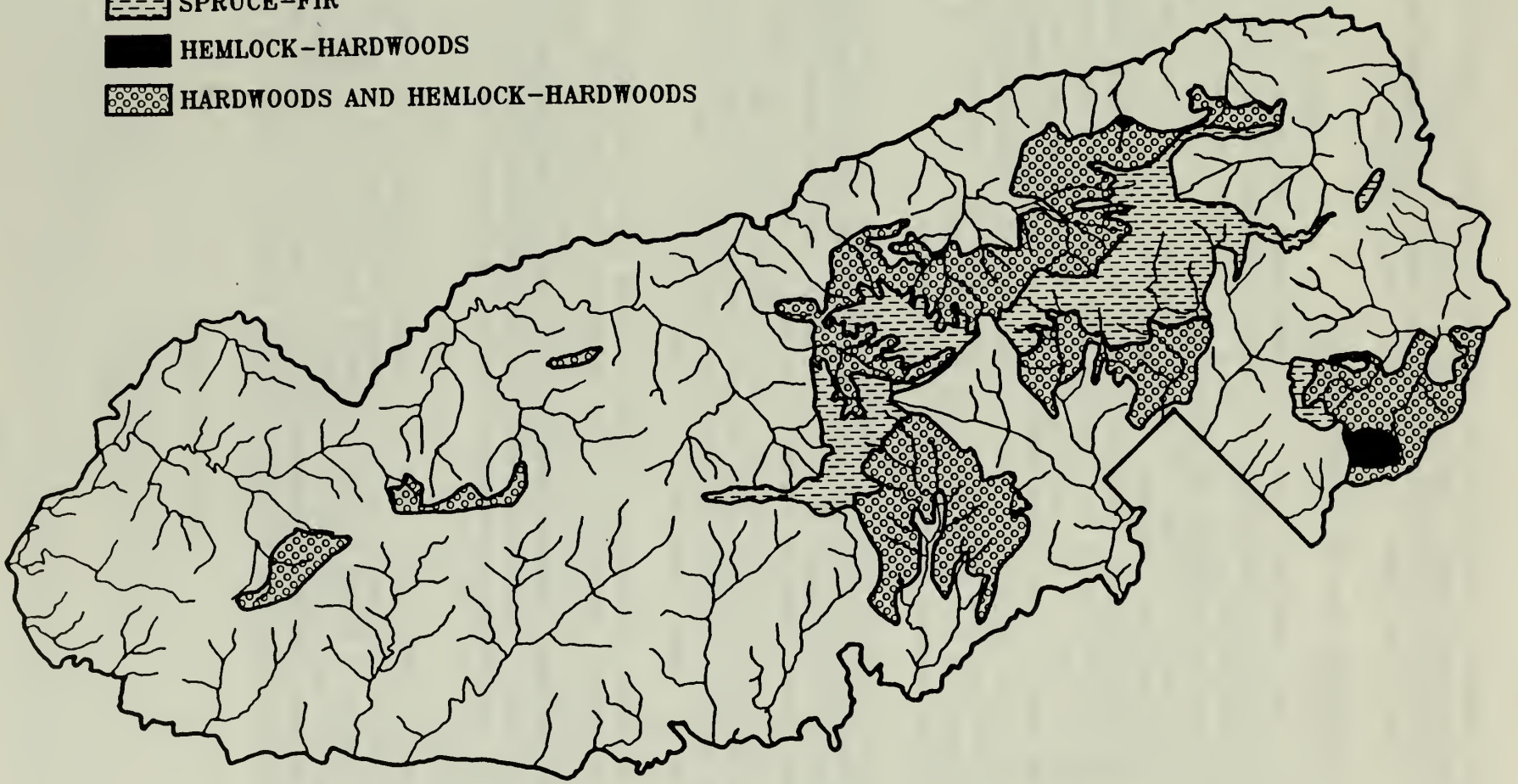

Figure 8. GRSM areas considered high in virgin forest attributes based upon little or no record of prepark disturbance.

general may be areas of "virgin" trees, not "virgin forests". That is, there are clearly trees present that predate settlers or logger's disturbance of the park. But on the whole, the virgin forest attributes found in the stands along these ridges are not overwhelming.

Conflicts In Estimated Area Of "Virgin" Forest.

The total area I consider "high in virgin forest attributes" is lower than the average of other estimates of "virgin," "primeval," or "old growth" forest in GRSM (Table 5). For Table 5, the various "virgin," etc. area estimates were standardized to reflect percentages of the total area within the 1984 boundary of GRSM. This was necessary because the area encompassed by the park has changed. GRSM has a lower areal extent than the total originally proposed. The estimate of Braun (1950) could not be easily standardized because it was given as a percentage without reference to the total park area. If one assumes that it reflects the proposed boundary of the park in 1941, then standardization to the 1984 boundary changes the estimated percent of virgin forest from 40 percent to 35 percent. The ensuing difference is not overwhelming when compared to the difference between the estimates from Map 72 (Pyle 1983a) or Figure 8 (this report) versus the average of the remaining estimates.

The purpose of Map 72 (GRSM "pristine" areas) and Map 76 (GRSM "pristine" areas and "virgin hardwoods") was to depict areas of GRSM that had no evidence of disturbance (R. Gerald Wright, personal communication, 1983). Wright's term "pristine" and my "little or no record of prepark disturbance" are conceptually similar. In contrast, others' use of "virgin," "primeval," or "old growth" allowed inclusion of areas I have termed "areas of big trees plus diffuse human activity." This can be seen by a comparison of Figure 8 and Map 72 to Maps 38 and 50.

On Map 76, Wright showed his "pristine" areas within the context of others' "virgin" areas. Wright's "virgin hardwoods" are generally analogous to my areas of "big trees plus diffuse human activity." Table 6 is a comparison of Map 76 versus areas of big trees and diffuse human activity (from Figure 3) plus areas with little or no record of disturbance (from Figure 8) versus the averages of "virgin," "primeval," and "old growth" estimates taken from Table 5.

The estimates shown for my work and that of Wright's are virtually the same. In most cases the general areas we mapped are also the same. While my work was based on a search of GRSM archival records, Wright's work included numerous field observations recorded in a field journal that was sent to the National Park Service Denver Service Center. (Correspondence with the librarian at the Denver Service Center failed to locate the journal.)

TABLE 5. Estimates of Virgin Forest in GRSM Standardized to 1984 Park Boundaries.

Source of Estimate	Description of Area	Percent of GRSM
Figure 8	High in virgin forest attributes	20%
Braun, 1950	Virgin	40%*
Jennison, 1939	Virgin hardwoods "upwards of"	39%
Campbell, 1960	Primeval "approx."	34%
Map 50	Virgin	38%
Map 57 (anon. reference to 1953 Master Plan on map)	Old growth	30%
Map 38	Virgin	40%
Map 72	Pristine	16%
Map 76	Virgin and pristine	28%

* Denotes area not easily standardized in terms of current Park boundary

TABLE 6. Comparison of Areas Described as Virgin, etc. When Areas of Diffuse Disturbance Are Included

Source of Estimate	Description of Area	Percent of GRSM
Figure 8 plus Figure 3	Areas with little or no record of prepark disturbance plus areas of big trees and diffuse human activity	28%
Map 76	Pristine, virgin	28%
Table 5 (average of all entries except Fig. 8, Map 72, Map 76)	Virgin, primeval, old growth	37%

DISCUSSION

Conceptual Frameworks Relevant To GRSM Disturbance History Mapping.

The framework within which one views vegetation disturbance is related both to the scale at which information is to be presented and the nature of the available information. Farming, for example, may be viewed in terms of farm field location. Farming may also be viewed within the framework of farming districts. When farming activities are viewed in terms of farm field location and many separate fields are mapped, a mosaic pattern of farm fields emerges. To see this pattern, it is necessary to use a map with a scale large enough to mark fields individually (e.g., 1:24,000).

If information is not discretely mappable (e.g., testimony to the effect that the slopes above a certain farming district were burned frequently) then a large scale map is not needed. In fact, a small scale map where one can see broad patterns within a larger framework may be more useful. For example, instead of plotting boundaries of individual farms, one plots generalized boundaries of farming districts above which some have associated general areas of frequent fire and some do not.

Likewise, logging can be viewed in different conceptual frameworks. There is the broad overview framework which includes areas with no record of human disturbance versus areas with selective cutting diffused through the landscape versus commercially clearcut areas. In contrast, clearcut areas can be viewed as discrete pieces of a mosaic and mapped as separate units adjacent to non-clearcut forest. A fine grained mosaic will be lost at the broad overview scale of presentation. Conversely, a broadly generalized pattern will appear inappropriate if shown at the 1:24,000 scale. Indeed, the visual pattern that would emerge from a 8 1/2" x 11" small scale overview map will pass unnoticed if one looks at the same boundaries on a single sheet of a 20-sheet set of large scale maps.

The conceptual framework does not necessarily have to be consistent for a map to be comprehensible. For example, a detailed legend or text accompanying a map (see Results section -Summary of anthropogenic disturbance pattern in GRSM and Appendix D) allows one to smoothly change framework from discretely bounded disturbances to generalized broad scale patterns on the same map. Likewise, the use of changing frameworks on a large scale map allows the presentation of a disturbance history picture that gives detailed information (such as farm field boundaries) but avoids giving the implicit idea that no disturbance at all took place in areas where discrete disturbance boundaries were not mappable.

Virgin Forest Attributes.

The forest conditions connoted by the words "virgin forest" determine the boundaries of areas mapped as "virgin." In GRSM, when the connotation of "virgin forest" is "all forest not extensively farmed or corporately logged", a large area may be considered "virgin". Such use of the term "virgin" was reasonable prior to park establishment when land was undergoing condemnation. The value of the land was based on its productivity. If there was potential for profitable timber harvest, a tract was "virgin forest."

However, examination of the current forest conditions and processes in the tracts labelled "virgin forest" during park acquisition reveals a gradient from little or no sign of disturbance to quite disturbed by combinations of early style logging, scattered farms, annual autumn burning, and livestock grazing. Because undisturbed forest should be managed differently than fairly disturbed forest, it was important to locate areas that could properly be considered undisturbed tracts within the 38 percent of the park shown as "virgin forest" on the land use maps made during condemnation procedures (see Maps 50, 51, 52, 53, 70, of Pyle 1983a).

Prior to location of undisturbed tracts, it was necessary to find a workable definition of "virgin forest." A first approximation was "a forest whose conditions and processes are wholly lacking in human influence". Unfortunately, such ideal conditions probably only exist in the abstract. A second method of defining virgin forest centered on use of a disturbance gradient, one end of which was the abstract virgin forest. Attempts at setting a cutoff point on the disturbance gradient (at which "virgin forests" would be forests disturbed to a lesser extent than those on the other side of the cut-off point) led to the following realizations. The GRSM disturbance gradient actually was a complex gradient (Whittaker 1975) composed of a multitude of disturbance gradients (i.e., early style logging, farming, grazing, fire, and other human-related disturbances). And, any individual tract would occupy a unique space within that complex gradient. Similarly, within the general concept of undisturbed forest, different degrees and types of disturbance are acceptable for different management contexts. Thus, I arrived at the concept of "virgin forest attributes" as a means of evaluating "virgin" forests.

Virgin forest attributes are attributes of the abstract ideal virgin forest (a forest in which there has been no human influence). Application of the concept is described below. First, the management context for areas believed to be high in virgin forest attributes must be defined. Second, the attributes needed to achieve such a management context must be identified. For example, for management action to be taken within the context of preserving pristine areas containing a high diversity of habitat types, areas of both little human disturbance and a high diversity of habitat types first must be located. Virgin attributes of forests with little human disturbance include the absence of disturbances such as logging, farming, and livestock grazing. In old growth Douglas-fir forests, Franklin et al. (1981) found that the presence of large trees, large standing snags, and large down trees (in streams as well as on the forest floor) promote a wide diversity of microhabitat type not found in younger forests. Forest conditions such as these can be considered virgin forest attributes in that they require stands of trees that have developed to an advanced age. (The old growth Douglas-fir stands of Franklin et al. are generally 350-500 years old.) Development to such an advanced age implies a lack of major disturbance, which in turn suggests a condition approaching the ideal virgin forest.

In GRSM, different areas in the lesser disturbed sections of the park have virgin forest attributes suited to differing management contexts. For example, an area such as Albright Grove has no record of disturbance by farm fields, logging, or livestock grazing. In addition, it has large trees, snags, and downed logs. Thus, Albright Grove would be considered

high in virgin forest attributes for the aforementioned hypothetical management context of preservation of pristine areas with a high diversity of habitat types. On the other hand, the west end of the park (where grazing and other disturbances were diffused throughout the landscape) would not be ranked high in virgin forest attributes in this context. Yet the virgin forest attributes of many stands in the west end would be worth examining if the management context were one for which the virgin forest attribute of "soils without the effects of plowing or log skidding" would cause an area to be highly ranked.

Forest stand evaluation using virgin attributes identified for a given management context requires careful decisions as to which virgin forest attributes are indeed important. However, once the decisions are made and a system of objective criteria for evaluation is set up, separate stands can be identified and ranked according to how well they meet the criteria. Evaluating "virgin" tracts using the concept of virgin forest attributes brings forth results that are both repeatable in terms of independent observers and well defined in terms of which forest attributes were taken into consideration.

Use Of The Information In This Report.

The most important use of the collated disturbance history material is as parkwide baseline data. The information collated on the 1:24,000 scale represents the condition of the park at the time of its establishment. Changes that have taken place during the last 50 years can be referenced to these baseline data. Also, additional information on disturbance (anthropogenic or natural) or management actions can be added and referenced within the larger context of major parkwide land use patterns.

Because of the complexity of the data, I organized the material into four basic themes: (1) fire; (2) buildings and cemeteries; (3) disturbance boundaries; and (4) roads, trails, and railroads. Computer digitization is one way to enable future reorganization of the data into project-related themes. For example, previous fire locations taken in combination with the locations of old roads, trails, and railroad beds results in a map useful for planning fire cache location and fire mobilization.

The small scale overview maps (Figures 1-8) provide a quick introduction to the park for seasonal interpreters as well as scientists and resource managers. Not only can these maps be used in seasonal training programs, they could be included in a park history pamphlet designed for visitor use.

Certain themes and individual information classes on the 1:24,000 scale map sets are directly useful. Old trails, roads, and railroads are helpful in planning new trails or relocating existing routes in the park trail system. Knowledge of old travel routes is helpful in predicting travel patterns of lost as well as lawless individuals. Old roads frequently lead to old homesites. Old homesites are suited for conversion to new backcountry campsites. They are generally situated on flat ground, are already disturbed, and have existing access.

Old homesites, although fairly common, are islands of unique habitat within the surrounding forest. This habitat is characterized by clearings,

prevalence of grassy as well as domesticated plant species, and, generally, a spring-fed water source. These characteristics are attractive to many species of wildlife, including the exotic wild hog. In fact, Bratton and Howe (1976) found a relationship between winter hog rooting and the presence of Chinese yams (Dioscorea batatas), which were introduced in the park and are still found today around old homesites. Keying into the location of old homesites and old roads and trails is also a logical foundation for planning an exotic plant survey.

The 1930s boundaries of vegetation of age class 1-20 years, as well as "Grass" and "Grass, restocking," now represent boundaries of vegetation under 70 years old. These are areas of nonstable vegetation. They can be used in visitor interpretation activities and for scientific research on forest dynamics. They also should be considered in resource management planning. For example, forest successional stage as well as type of past disturbance are two of many factors important in predicting fire susceptibility and rate of fire spread in forested conditions.

Trees of age class 1-20 years at the time of park establishment (1934) are now 50 to 70 years old. For oak forests, in Western North Carolina, this age class has been found by the U.S.D.A. Forest Service (1971) to be a high yield mast production class. Goodrum et al. (1971), who studied oak trees up to 99 years old in Texas, generalized that acorn yields increased as trees matured, except when the crowns became shaded or "older" trees had portions of the crown die. The results of these two studies suggest that the age class 1-20 oak chestnut type (now 50 to 70 years old) mapped by Miller may now be at a high yield stage. This should be taken into consideration in mast survey design as well as in monitoring of wildlife movements, particularly in years of poor mast.

Implication Of Results For GRSM Management.

The fact that much of the park supports successional vegetation (whether due to discretely bounded disturbances or to disturbances diffused through the forest) means that much of the landscape is undergoing change. Park managers must address the issue of what changes are acceptable within the framework of protecting the native flora and fauna. Recently, a decision was made to actively prevent natural succession from obliterating two of the 16 grassy balds in the park. According to the 1984 GRSM Resource Management Plan, management will perpetuate the historic open condition that favors the rare plants presently found on these balds. On the remainder of the balds, natural succession processes will be allowed to continue.

Similarly, many areas of formerly high pine density are undergoing succession to hardwood forests. Pine stands are not expected to entirely disappear from the park, but their importance in the landscape is likely to be reduced due to the absence of the frequency and type of fires once found in GRSM. Clearly, fires set by settlers promoted pine in the west end of the park (Harmon 1981). Whether settlers' fires represent a change from American Indians' pattern of activity in this specific part of the park is not known. However the presence of pine in the landscape contributed to the habitat diversity found in the park in the 1930's and is typical of the result of burning by Indians in the southern Appalachians prior to European arrival (Harmon et al. 1983).

My work (Fig. 8) shows that about 20 percent of the park is relatively undisturbed. This is considerably less than either the conventional folk wisdom that the park is "about one third virgin" or the figure of "40 percent virgin" given by Braun (1950). Consequently, the areas I have identified as high in virgin forest attributes should be all the more valued for their uncommonness in the landscape. For park baseline data, we need a better understanding of the history, conditions, and dynamics (i.e., the processes and changes) of these forests. Such baseline data can be obtained by monitoring permanent plots and by actively researching the history and current processes taking place in these forests.

Future Disturbance History Work In GRSM.

Much of the park's vegetation pattern is a result of disturbance. On one hand, the baseline map data I have collated provides a foundation and impetus for future work on anthropogenic disturbance related issues and problems. On the other hand, the areas for which I found no record of disturbance are considered high in virgin forest attributes. These are the forest characteristics that come to mind when most people think of the park. Therefore, it is important that future disturbance history work include an evaluation of the park's relatively undisturbed forests. Table 7 lists future project titles organized under six headings. The project titles are based on application of the collated information described in this report or on questions which this work has suggested.

TABLE 7 Future Disturbance History Work in GRSM

USE AND MANIPULATION OF THE COLLATED INFORMATION DESCRIBED IN THIS REPORT

1. Survey of old homesites and prepark travel routes in order to determine locations and status of exotic plant populations for purposes of establishing priorities and plans for management

2. Digitization of the collated 1:24,000 scale mapsets: prepark building and cemetery locations; disturbance boundaries; fires; and roads, trails and railroads

FOREST CONDITIONS FOLLOWING ANTHROPOGENIC DISTURBANCE

1. Failure of spruce to regenerate following fire

2. Failure of spruce to regenerate following logging in mixed spruce-hardwood forests

3. Factors affecting old homesite recovery

4. Contrasts in forest succession following logging versus farming

5. Effects of anthropogenic disturbance on fuel loadings

6. Were the large areas of heath in Big Creek and the Little River (Elkmont and Tremont) watersheds initiated by logging slash fires?

FOREST SUCCESSION FOLLOWING CESSATION OF PRE-PARK LAND USE PRACTICES

1. Changes in the west end of GRSM due to cessation of settlers' burning activities
   a. focusing at the species and habitat scale
   b. focusing at the landscape diversity scale

2. The rate of disappearance of rare plants in anthropogenically created habitat (drainage ditches) following natural succession in Cades Cove

3. Interpretive program for GRSM historic sites that includes interpretation of surrounding successional vegetation in the context of former land use

DOCUMENTATION OF DISTURBANCE FOLLOWING PARK ESTABLISHMENT

1. Development of computerized database to record current and future vegetation disturbance events

2. Documentation of disturbances, other than fire, 1935-1985

TABLE 7, CONTINUED Future Disturbance History Work in GRSM

INVESTIGATION OF DIFFUSE DISTURBANCE

1. The extent (geographical and seasonal) of livestock grazing outside settled areas of GRSM

2. Movements, feeding habits, and capture of free ranging domestic pigs in the prepark Great Smoky Mountains

3. Pattern and location of Indian fire setting activities in GRSM

4. Overview of prepark industry (mines, charcoal production, tan bark gathering, early style logging) in areas not logged by major lumber companies

INVESTIGATION OF FORESTS HIGH IN VIRGIN ATTRIBUTES

1. Development of criteria and methods to define and locate GRSM forest stands highest in virgin attributes important to national park management context (This should be done separately by forest type; e.g., cove hardwoods, hardwood-hemlock, spruce-fir, oak)

2. Evaluation of forest high in virgin attributes in terms of
   a. special protection needs
   b. long term ecosystem monitoring potential

3. Long term pattern of natural vegetation disturbance prior to park establishment

4. Succession following a specific natural disturbance in GRSM
   a. landslides
   b. rhododendron dynamics in areas of overstory break up
   c. blowdowns (of entire stands)

5. Succession following chestnut blight in forests determined by this report to otherwise be high in virgin forest attributes

6. The rate of big tree stand break up versus big tree stand development in GRSM--i.e., are big tree stands disappearing from the park landscape?

REFERENCES CITED

Written References

Arends, E. 1981. Vegetation patterns a half century following the chestnut blight in the Great Smoky Mountains National Park. M.S. Thesis. University of Tennessee, Knoxville. 79 pp.

Ayres, H. B. and W. W. Ashe, 1905. The Southern Appalachian forests. United States Dept. of the Interior, United States Geological Survey Professional Paper No. 37, Series H, Forestry 12. Washington, D. C., U. S. Government Printing Office.

Bratton, S. P., 1980. Impacts of white-tailed deer on the vegetation of Cades Cove, Great Smoky Mountains National Park. U. S. Dept. Interior, National Park Service, SE Region, Uplands Field Research Lab., GSMNP. Report for the Superintendent. 36 pp.

Braun, E. L., 1950. Deciduous forests of eastern North America. Blakiston Co., Philadelphia, Pennsylvania. 596 pp.

Brewer, A., and C. Brewer, 1975. Valley So Wild: A folk history. East Tennessee Historical Society, Knoxville, 382 pp.

Bruhn, M. E., 1964. Vegetational succession on three grassy balds of the Great Smoky Mountains. M. S. Thesis, University of Tennessee, Knoxville, 84 pp.

Buckley, S. B., 1859. Mountains of North Carolina and Tennessee. Amer. Journ. Sci. and Arts (2nd Series) 27: 286-294.

Campbell, C. C., 1960. Birth of a national park. University of Tennessee Press, Kingsport, Tennessee, 155 pp.

Chapman, J., P. A. Delcourt, P. A. Cridlebaugh, A. B. Shea, and H. R. Delcourt, 1982. Man-land interaction: 10,000 years of American Indian impact on native ecosystems in the lower Little Tennessee River Valley, East Tennessee. Southeastern Archaeology.

Dickens, R. S., 1976. Cherokee Prehistory: The Pisgah Phase in the Appalachian summit region. The University of Tennessee Press, Knoxville, 243 pp.

Franklin, J. F., K. Cromack, Jr., W. Denison, A. McKee, C. Maser, J. Sedell, F. Swanson, and G. Juday, 1981. Ecological characteristics of old-growth Douglas-fir forests. U.S.D.A. Forest Service, Pacific Northwest Forest and Range Experiment Station, General Technical Report, PNW-118.

Frome, M., 1966. Strangers in high places: The story of the Great Smoky Mountains. Doubleday and Company, Inc., New York, 394 pp.

Goodrum, P. D., V. H. Reid, and C. E. Boyd, 1971. Acorn yields, characteristics, and management criteria of oaks for wildlife. J. Wildlife Management 35: 520-532.

Goodwin, G. C., 1977. Cherokees in transition: A study of changing culture and environment prior to 1775. Res. Paper No. 181, University of Chicago, Dept. Geogr., Chicago, Illinois, 177 pp.

Guyot, A., 1938. Notes on the goegraphy of the mountain district of western North Carolina. N. C. Hist. Rev., Raleigh 15(3): 251-318.

Harmon, M. E., 1981. Fire history of Great Smoky Mountains National Park--1940 to 1979. National Park Service, Southeast Regional Office Res./Resour. Manage. Rep. 46. 39 pp.

Harmon, M. E., S. P. Bratton, and P. S. White, 1983. Disturbance and vegetation response in relation to environmental gradients in the Great Smoky Mountains. Vegetatio 55: 129-139.

Holmes, J. S. 1911. Forest conditions in western North Carolina. North Carolina Geologic and Economic Survey Bull. 23: 1-116.

Howe, T. D. and S. P. Bratton, 1976. Winter rooting activity of the European wild boar in the Great Smoky Mountains National Park. Castanea 41: 256-264.

Jennison, H. M., 1939. Flora of the Great Smokies. J.Tenn. Acad. Sci. 14 266-298.

Kuykendall, N. W., III, 1978. Composition and structure of replacement forest stands following southern pine bettle infestations as related to selected site variables in the Great Smoky Mountains. M. S. Thesis, University of Tennessee, Knoxville. 122 pp.

Lambert, R. S., 1957. The pioneer history of the Great Smoky Mountains National Park: A report to the Superintendent based on documentary sources. Great Smoky Mountains National Park, Gatlinburg, 96 pp.

Lambert, R. S., 1958. Logging in the Great Smokies National Park, A report to the Superintendent. Great Smoky Mountains National Park, Gatlinburg, 71 pp.

Lindsay, M., 1976. History of the grassy balds in the Great Smoky Mountains National Park. U.S. Dept. Interior, National Park Service, SE Region, Uplands Field Research Lab., GSMNP. Management Report, No. 4. 215 pp.

Lindsay, M. M. and S. P. Bratton, 1979. The vegetation of grassy balds and other high elevation disturbed areas in the Great Smoky Mountains National Park. Bull. Torrey Bot. Club 106:264-275.

McCracken, W. H., III, 1978. Comparison of forest cover prior to and following disturbance in two areas of the Great Smoky Mountains National Park. M. S. Thesis, University of Tennessee, Knoxville. 87 pp.

Miller, F. H., 1938. Brief narrative descriptions of the vegetative types in the Great Smoky Mountains National Park. Unpubl. Mimeo. 10pp.

Olmsted, F. L., 1860. A Journey to the Back Country, Mason Brothers, N. Y., 492 pp.

Pyle, C., 1983a. FY1983 Disturbance History Report. Typewritten manuscript on file at Uplands Field Research Lab., GRSM, 15 pp. Appendices (A-E).

Pyle, C., 1983b. Description (with respect to continued documentation of GRSM disturbance history) of visually oriented information sources in the GRSM Archives concerned with anthropogenic vegetation disturbance. Memorandum to the files, Uplands Field Res. Lab., GRSM, 8 pp.

Pyle, C., 1984. Pre-Park disturbance in the spruce-fir forests of Great Smoky Mountains National Park. In P. S. White (ed.), The Southern Appalachian spruce-fir ecosystem, its biology and threats. National Park Service, SE Regional Office, Research/Resources Management Report No. 71.

Silsbee, D. G. and G. L. Larson, 1983. A comparison of streams in logged and unlogged areas of Great Smoky Mountains National Park. Hydrobiologia 102: 99-111.

Stratton, D. A., and P. S. White, 1982. Grassy balds of Great Smoky Mountains National Park: Vascular plant floristics, rare plant distributions, and an assessment of the floristic data base. USDI, NPS, SERO, Research/Resources Management Report SER-58.

Timberlake, H. 1765. Memoirs. Continental Book Co. (1948 ed.), Marietta, Georgia, 197 pp.

United States Dept. of Agriculture, Forest Service, Southern Region, 1971. FSH 2609.23R, Wildlife Management Handbook.
Van Doren, M., ed., 1928. Travels of William Bartram. Macy-Masius, New York, 414 pp.
Whittaker, R. H., 1975. Communities and Ecosystems, 2nd ed. Macmillan Co., New York, 385 pp.
Woods, F. W. and R. E. Shanks, 1957. Replacement of chestnut in the Great Smoky Mountains of Tennessee and North Carolina. J. Forestry 55: 847.
Woods, F. W. and R. E. Shanks, 1959. Natural replacement of chestnut by other species in the Great Smoky Mountains National Park.Ecology 40: 349-361.

Map References

Maps numbered according to Uplands Lab Map Index (see Pyle 1983a)

Map 2 Champion Fibre Company, ca. 1918. Smoky Mountain Timberlands. Scale 1:63,369.
Map 38 Miller, Frank, 1942. Great Smoky Mountains National Park, Wilderness Area. Scale 1:62,500.
Map 43 Ayres, H. B. and W. W. Ashe, 1904. Land Classification Map for Southern Appalachian Region. Scale: 1:375,000.
Map 50 White, R. P., and G. L. Preston, Jr., 1933. Untitled Land Use Map. Scale 1:63,360.
Map 55 Anon., circa 1928-1930. Untitled Map, North Carolina only. Scale 1:125,000.
Map 56 Miller, Frank, circa 1938. The Miller Map, untitled copy. Scale 1:62,500.
Map 57 Miller, Frank, circa 1938. The Miller Map, titled "Vegetation Type Map". Scale 1:62,500.
Map 60 Grossman, Charles S., and Hiram C. Wilburn, circa 1935. Untitled set of 24 maps showing structures existing in the Park in 1935. Scale 1:24,000.
Map 72 Wright, R. G., circa 1974. Pristine Areas. Scale 1:125,000.
Map 76 Wright, R. G., circa 1974. Virgin Forest Lands, copy B. Scale 1:125,000.
Map 80 Tennent, Gaillard, 1904. Untitled Map, covers part of North Carolina. Scale 1:63,360.
Map 85 Tennessee Valley Authority, circa 1939. Ocular Type Maps. Scale 1:24,000.
Map 86 Robinson, Tom, 1979. Cemetery Maps. Scale 1:24,000.
Map 87 Morrell, John, circa 1962. Cemetery Map. Scale 1:63,360.
Map 88 Morrell, John, circa 1962. Cemetery Maps. Scale 1:24,000.
Map 90 Harmon, Mark, 1979. Fire Maps. Set of 26. Scale 1:24,000.
Map 91 Anon., circa 1949. Great Smoky Mountains National Park, Fire Occurrence Map, 1940-1949. Scale 1:62,500.
Map 92 Anon., circa 1939. Great Smoky Mountains National Park, Fire Occurrence Map, 1931-1939. Scale 1:62,500.
Map 95 Anon., circa 1925? Untitled Map of Eagle Creek watershed. Scale 1 inch = 80 poles.
Map 96 Ritter Lumber Company, circa 1925-1927. Photostats of Tax Questionnaire Maps. Scale: about 1:187,000.
Map 98 National Park Service, Denver Service Center. Digitized outline of Major GRSM watersheds with acreages computed. Scale of about 1:125,000.
Map 99 Anon., circa 1931-1939. Mercurochrome Map. Scale: 1:63,360.

APPENDICES A, B, C, AND D

APPENDIX A. IMPORTANT PREPARK DISTURBANCE HISTORY INFORMATION SOURCES AVAILABLE AT GREAT SMOKY MOUNTAINS NATIONAL PARK (GRSM)

The major sources of parkwide disturbance history information at GRSM are maps, air photos and two written summaries done by Robert S. Lambert on logging and pioneer activities. To understand and make the best use of air photos, field work is required. Because this project was a study of disturbance via archival records, it did not lead to evaluation of the usefulness of the available air photos. These photos span a time period from 1926 to 1982. However, not every flight covered the entire park.

Lambert's summaries are in the form of unpublished reports to the Park Superintendent (entitled The Pioneer History of Great Smoky Mountains National Park, 1957 and Logging in the Great Smoky Mountains National Park, 1958). His meticulously researched work draws upon and references other less easily accessible written material in the GRSM Archives. Lambert's reports are oriented to the major watershed level. For example, the Cataloochee Creek drainage is for the most part discussed as a whole rather than with site specific information given for every small creek, slope, or ridgetop within the area.

In contrast to the major watershed approach, some of the maps discussed below exhibit patterns of much finer detail. Table A-1 describes important maps (available at GRSM) which are considered reliable and useful for disturbance history work. An evaluation as to their usefulness for site specific field work is included.

General constraints to use of the maps listed in Table 1 are based on scale, level of detail, and time specificity. Information from (for example) the 1930's is indicative of 1930's conditions. While an understanding of 1930's conditions aids in understanding present vegetation patterns, the conditions of the 1930's must not be taken for the present day conditions nor for conditions of the more remote past. For example, Miller's map (based on field work done in the late 1930's), shows "grass" and "grass, restocking" which may be interpreted as open fields and recently abandoned fields. Today these areas are not open. Similarly, fields abandoned in 1900 were not open in the 1930's, and consequently were not shown by Miller.

In Table A-1 below I rated the level of detail as "high" (information shown in enough detail to warrant use of 1:24,000 scale), "low" (information presented at a broad scale, generally at the major watershed level), or "medium" (information with detail between the high and low levels). The level of detail in combination with scale places constraints on the applicability of the information. While highly detailed information suited to site specific work can be summarized into a broadscope pattern, broadly generalized information (of either a low level of detail and/or a small scale) cannot be interpreted and used in a site specific manner.

Table A-2 details the type of information available on the maps listed in Table A-1. The rating, with respect to usefulness in the field, was based on scale, level of detail, and whether contours were discernible.

Table A-1. Map Information Sources.

Description/ Name of Map	Location	Type of Information	Date	Level of detail presented	Scale	Contour map
Miller Map (Map 56 in Pyle 1983a)	Sugarlands Visitor	Vegetation types, fire, "cutover" line, age class	1935-1938	High	1:62,500	Yes
Wilderness Overlay (Map 38)	GRSM Archives	General forest types, land use	1942	Medium	1:62,500	No
Land Use Maps (Maps 50, 51, 52, 53)	GRSM Archives	General forest types, land use	1933	Low	1:63,360	No
TVA Ocular Type Maps (Map 85)	GRSM	Vegetation type, stocking	1939	Medium	1:24,000	No
Eagar's Spruce Fir Maps (Map 12)	Uplands Lab.	Vegetation type, disturbance	1981	High	1:24,000	Yes
Ayres and Ashe Southern Appalachian Map (Map 43)	GRSM Archives	Stocking, fire	1904	Low	1:375,000	Yes
North Carolina Lumber Companies (Map 55)	GRSM Archives	General land use	ca. 1928	Medium	1:125,000	Yes
Tennessee Pre-Park Land Use (Map 58) "Maloney Map"	GRSM Archives	General land use	ca. 1927	Medium	1:125,000	Yes
Mercurochrome Map (Map 99)	GRSM Archives	Pre-park land ownership	1930s	High	1:63,360	No
Buildings Map (Map 60)	GRSM	Building type	1935	High	1:24,000	Yes

Table A-1. (cont.)

Description/ Name of Map	Location	Type of information	Date	Level of detail presented	Scale	Contour map?
Resources Management Planning Maps (Maps 69, 71, 72, 73, 74, 76, 77)	GRSM Archives and GRSM Resources Management	Cemeteries and various land classifications	1974	Medium	1:125,000	Yes
Robbins' Cemetery Maps (Map 86)	GRSM Archives	Cemetery locations	1979	High	1:24,000	Yes
Morrell's Parkwide Cemetery Map (Map 87)	GRSM Archives	Cemetery locations	1960	Medium	1:63,360	No
Morrell's Working Cemetery Maps (Map 88)	GRSM Archives	Cemetery locations	1960	High	1:24,000	Yes
Harmon's Fire Maps (Map 94)	Uplands Lab.	Fire locations	1979	High	1:24,000	Yes
Fires 1940-1949 (Map 91)	GRSM Resources Management	Fire locations	ca. 1949	Medium	1:62,500	Yes
Fires 1930-1939	GRSM Resources Management	Fire locations	ca. 1939	Medium	1:62,500	No

Table A-2. Detailed description of maps.

Description/Name of Map	Type of Information Available	Usefulness in in the field
Miller Map (Map 56)	Vegetation types--spruce, northern hardwoods, oak and chestnut, hemlock, cove hardwoods, yellow pine-hardwoods, white pine-hardwoods, heath bald, grass. Age class--1-20 years, 20-40 years, all aged. "Burned over"--boundaries and dates (when known) of fires that burned intensely enough to change species composition, age class, or forest condition. "Cut over" line--a line used by Miller to show areas severely culled in the past logging operations. (See Frank H. Miller, 1938, Brief narrative descriptions of the vegetative types in Great Smoky Mountains National Park.) Note that the line "does not separate the vrigin and cutover areas."	High
Wilderness Overlay (Map 38)	Vegetation type--virgin spruce and balsam; virgin hardwoods and hemlock; heath balds. Generalized land use boundaries (depicted for the most part at the major watershed level)--light cut, best trees taken; heavy cut; cleared or farmland; burned over.	Medium
Land Use Maps (Maps 50, 51, 52, 53)	Cover types--virgin spruce and balsam; virgin hardwoods hemlocks; barren Generalized land use boundaries (depicted at the major watershed level)--light cut; heavy cut; cut over and burned; cleared or farmland.	Low
TVA Ocular Type Maps (Map set 85)	Timber type--upland hardwoods, oak-chestnut, blackjack oak-hardwoods, yellow-pine hardwoods, white pine-hardwoods, northern hardwoods, yellow pine (other than loblolly), white pine, spruce-fir, hemlock, hemlock-white pine. Stocking--thousands of merchantable board feet per acre; cords per acre subdivided into chestnut, pulpwood (coniferous) and hardwood. Land use--open fields, buildings, roads.	Medium

Table A-2. (cont.)

Description/Name of Map	Type of Information Available	Usefulness in the Field
Eagar's Spruce-fir Maps (Map set 12)	Forest cover type--Fraser fir, Fraser fir-yellow birch, red spruce-Fraser fir, red spruce, red spruce-yellow birch, red spruce-rhododendron, Norway spruce, yellow birch, beech gaps, northern hardwoods, hemlock dominated northern hardwoods, heath balds, burn scars with herbs, blowdown scars with herbs, debris avalanches. Disturbance type--balsam woolly aphid infestation (not a pre-park disturbance), logging, fire.	High
Ayres and Ashe Map (Map 43)	Land classification--cleared; burned and restocking; or stocked with either 1,000-2,000, 2,000-5,000, 5,000-10,000, or 10,000-25,000 feet B.M. (Board Measure) per acre.	Low
North Carolina Lumber (Map 55)	Land use classification--virgin timber, culled, fields and woods, active logging operations, railroad location. Ownership boundaries	
Tennessee Pre-Park Land (Map 58) "Maloney Map"	Classification scheme: virgin timber; cut over 20 years; cut under 20 years; mixed second growth and cleared land. Corporate ownerships are outlined.	Low
Mercurochrome Map (Map 99)	Tracts outlined to scale and colored in with mercurochrome as acquired for GRSM. Last owner and acreage indicated.	Low
Buildings Map (Map 60)	Structures existing within the park boundary in 1935: occupant's name, type (use) of building, form of construction. Base maps are pre-1935 and show other buildings, roads, trails, and railroads.	High

Table A-2. (cont.)

Description/Name of Map	Type of Information Available	Usefulness in the Field
Resources Management Planning Maps (Maps 69, 71, 72, 73, 74, 76, 77)	Historical sites Cemetery locations Land classification: spruce-fir, "pristine" and "virgin" hardwoods, grass balds, "cultivated land.	Low
Robbin's Cemetery Maps (Map 86)	Name and location of cemeteries to be maintained by GRSM.	High
Morrell's Parkwide Cemetery Map (Map 87)	Cemeteries with numbers corresponding to notebook of information on cemetery status and burials in GRSM.	Low
Morrell's Working Maps (Map 88)	Cemetery name and location (map set not complete for the park).	High
Harmon's Fire Maps (Map 90)	Fire locations for fires with written reports. Fire scar locations for fire scars sampled by Harmon.	High
Fires 1940-1949 (Map 91)	Fire location, size class, cause, year	Medium
Fires 1930-1939 (Map 92)	Fire location, size class, cause, year. The available copy of this map is an overlay without contours. It overlays Map 91.	Medium

APPENDIX B. PREPARATION AND USE OF 1:24,000 SCALE MAP SETS DESCRIBED IN THIS REPORT

INTRODUCTION

The disturbance history information summarized in Figures 1-8 (of the main body of this report) was taken in part from four sets of 1:24,000 scale maps discussed herein. Each of the four sets of maps in turn represents a collation of data from both mapped and written sources. Preparation and use of the map sets will be described below under the following headings: "Boundaries", "Buildings and Cemeteries", "Roads, Trails, and Railroads" and "Fire".

Boundaries. The lines and areas shown on the "Boundaries" map set are based on collation of information from several maps. As an intermediate step, a series of 1:24,000 scale overlays was prepared so that information from maps of varying scales could be simultaneously compared. Table B-1 is a matrix of overlays and their contents. Information appearing on the "Boundaries" map set represents a distillation of what was put onto the overlays, with the occasional addition of material from other sources. Decisions as to what information to transfer to the final "Boundaries" map set were based on the following factors:

1. Quality of the original map with respect to accuracy in transferring the information to 1:24,000 scale. (This was judged mainly on presence of contours, correctness of topographic detail, and difficulties involved with changing map scale.)
2. Presumed reliability of the information.
3. Degree of detail. (Fine grained detail was generally chosen over the broad scale approach.)
4. Clarity of meaning in the terminology used on the original map.
5. Uniqueness of information.

The contrast between the Miller Map (Map 56) and the Tennessee Valley Authority (TVA) maps (Map set 85) can be used for illustration of these factors. Miller's work was done on a topographic map. The TVA maps had no contours. In addition, except for areas in North Carolina acquired by TVA and later deeded to the park, the TVA maps had no roads or streams shown. Disregarding the obvious limitations to the precision of the TVA maps, both TVA and Miller were assumed to be generally reliable. However, Miller's perspective was forest ecology while TVA's was merchantable timber. This resulted in differing degrees and emphasis of detail. It appears that TVA mapped areas as "open" when they were lacking in trees of merchantable size. On the other hand, Miller was interested in forest succession and made the distinction between "Grass, open" (fields), "Grass, restocking" (old fields), and "age class 1-20 years" (cleared areas in which a mappable vegetation type was emerging). Because Miller was not concerned with timber production, he made no distinction between heavily and sparsely

stocked stands. TVA, on the other hand, (as part of their Valley-wide forest inventory) chose to indicate stocking in thousands of merchantable board feet of timber per acre and cords per acre as well. These stocking designations gave additional detail over the work of Miller (and others as well). Where TVA's open areas overlapped with Miller's "Grass" or "age class 1-20 years", Miller's information was chosen both for its greater detail and its clarity of terminology. When no other information was available for a given area and TVA's stocking suggested disturbance (or lack of disturbance), the TVA boundaries were shown, despite the fact that they were hard to transfer precisely due to the absence of contours on the original maps.

Table B-2 is a key to the codes used on the "Boundaries" map set. The codes involve colors as well as symbols or labels. In general symbols and labels are done in the same color as the boundary they reference. Exceptions occur when two different map sources depict information with boundaries in common. In some cases, tick marks of contrasting color were used along common boundaries. In other cases, most notably where the purple "cutting line" coincided with the brown "light cut/heavy cut" boundary, the line was drawn in one color (purple) and labelled with additional information in the other color (brown).

TABLE B-1. "Boundaries" Overlays

Overlay Name	Information Type	Source	Depiction on Overlay
MILLER	Cutting line	Miller Map (Map 56; Pyle 1983a)	Green ticks along pencil line
	Burned areas	Miller Map	Red outline
	Degree of disturbance (virgin, heavy cut, light cut, open)	Wilderness Overlay (Map 38; Pyle, 1983a)	Yellow ticks along pencil line
	Degree of disturance	Land use map 51 (Map 51; Pyle, 1983a)	Brown colored pencil
Farming	Disturbed areas with discrete boundaries	Miller Map	Outlined areas (for symbol codes refer to Table B-2)
Lumbering	Land use (virgin, culled, fields and woods, active cutting)	Anonymous Lumbering Map (Map 55; Pyle 1983a)	Labelled boundaries (information for North Carolina only)
TVA maps	Open areas	Vellum copies of TVA original ocular type maps (Map 85;Pyle,1983a)	Outlined in blue ink
	Timber type and stocking	Map 85	Outlined and labelled according to TVA 1942. Regional Forestry Studies Valleywide Forest Survey. Typed mat'l assembled as a guide in the performance of field
Maloney	Land use (Virgin, cut 1-20 years, cut 20-40 years, small landholdings)	Maloney Map (Map 58; Pyle 1983a)	Labelled boundaries (Kinzel Springs, Blockhouse, and Calderwood topographic sheets only)
Suncrest	Timber classification	Suncrest Lumber Company Map (Map 59; Pyle, 1983a)	Labelled areas (Bunches Bald topographic sheet only)

TABLE B-2. Key to codes used on disturbance history "Boundaries" map set.

Color Code	Information Type	Original Source	Symbol Codes/Labels
Black	Disturbed areas with discrete boundaries	Miller Map (Map 56; Pyle,1983a)	G = Grass Go = Grass, open Gr = Grass, restocking CH 1-20=Cove hardwds age class 1-20 yrs OC 1-20=Oak chestnut age class 1-20 yrs YPH 1-20=Yellow pine hrdwds, age class 1-20 yrs NH 1-20=No. hardwds age class 1-20 yrs 21-40 = Age class 21-40 years AA = All aged CO = Cut over COr=cut over, restocking R = Rock Blowdown = Blowdown
Black	Written comments in map margins	Robert S.Lambert, 1958.Logging in the Great Smoky Mountains NP	X,*,(*),etc. are used on the maps to reference marginal comments derived from Lambert, 1958
Blue	Open areas; areas of low timber stocking; areas of high timber stocking	TVA ocular type maps (Map 85)	O = open MBF=thousand brd ft of merchantable timber per acre Timber Type Codes H=Upland hardwoods HC=Oak-chestnut Hm=Hemlock HmH=Hemlock-hardwoods HW=Hemlock-white pine M=Mixed yellow pine-hardwoods NH=Northern hardwoods S=Spruce fir WH-White pine-hrdwoods WP=White pine

TABLE B-2 Continued

Color Code	Information Type	Original Source	Symbol Codes/Labels
			HC 38 = 602 typical ex. of orig. maps' timber type and stocking code Hc=Oak-chestnut 3=3 thousand brd.ft. of merchantable timber /acre 8=8 cords of mer.wood /acre which can be divided into: 6 crd chestnut/acre 0 crd conifers/acre 2 crd other hrdwd/acre
Purple	Cutting line.Refer Frank H. Miller,1938 "Brief Narrative descriptions of the vegetative types in GRSM" Miller used a "cut-over" line "to show in a general way, the areas severely culled in the past logging operations"	Miller Map (Map 56)	
Brown	Broad scale degree of disturbance	Wilderness overlay (Map 38)	LC=Light cut HC=Heavy cut Virgin=Virgin Open=Cleared/farmland
Green	Misc. land use or ownership boundaries	Maloney Map (Map 58),Anon.Lumbering map (Map 55), Suncrest Lmbr Co Map (Map 59), Ayres and Ashe Map (Map 43), Champion Fibre Co Map (Map 2), Land Use Map (Map 51), Eagle Crk Map (Map 95) and Ritter Lmbr Co Questionnaire Maps (Map set 96)	X,*,(*),etc. were used following boundary labels done in green in order to reference to marginal notes stating original source of information

Buildings and Cemeteries. Cemetery and building locations were copied from the maps listed in Table B-3. The primary source of information on building locations was Grossman and Wilburn's set of maps (Map 60 Pyle,1983a) showing structures existing in the park in 1935. Because their map set specified building type, and building type was felt to add insight into previous land use, the buildings were coded as follows:

1 House or cabin
2 House plus outbuildings
3 Outbuildings only (e.g.,barn, corn crib, shed)
4 Mill
5 Church
6 Unspecified or other--present on Map 60,or 85
7 Building present on base map of mapset 60, or 85
7a Building information from W. Acree
8 School
9 Cemetery
0 Mark on map unable to be interpreted

TABLE B-3. Buildings and Cemeteries Source Maps

Map	Scale	Contours	Buildings	Cemeteries
Grossman and Wilburn (Map 60)	1:24,000	yes	yes	yes
TVA maps (Map 85)	1:24,000	no	yes	yes
T. Robbins Cemetery Maps (Map 86)	1:24,000	yes	no	yes
John Morrell's cemetery map (Map 87)	1:63,360	no	no	yes
John Morrell's working maps (Map 88)	1:24,000	yes	no	yes

Information from the TVA maps (Map 85) can be distinguished from that of Grossman and Wilburn because the houses shown on TVA maps are only in areas of the park once owned by TVA and not mapped by Grossman and Wilburn.

Cemeteries were labelled with codes indicating source of information as follows:

A = T. Robbins cemetery maps
B = John Morrell's cemetery map
C = John Morrell's working maps
D = Cemetery information from W. Acree

Roads, Trails, and Railroads. The Great Smoky Mountains National Park Advance Contour Sheets (the base maps on which Grossman and Wilburn's buildings information is plotted) were the main source of information for pre-Park roads, trails and railroads. Additional information was received from Dwight McCarter, GRSM Backcountry Patrol (personal communication). Notes were included on the maps when the information source was other than Grossman and Wilburn.

Table B-4 describes how information was coded onto the final map set. Use of a time frame code in conjunction with a color code allowed depiction of situations such as that of a modern day trail following an old road or railroad bed.

TABLE B-4. Coding system for "Roads, Trails, and Railroads" map set

Travel Route Type	Color Code	Time Frame Code
Road	Black	
Trail	Blue	
Railroad	Red	
Abandoned Travel Route		----
Currently Used Travel Route		////

Fire. Information on fires was taken from three map sources: Narrative fire records, Fire Occurrence maps, and the Miller Map. Table B-5 lists the sources and method of transfer to the 1:24,000 scale map set. Fires from the narrative fire records had been previously mapped at the 1:24,000 scale under the direction of Mark Harmon (Harmon, 1981). These fire records began in 1942 and represent only fires to which park personnel responded. Likewise the Fire Occurrence Maps (which date back to 1931) record only fires for which a crew was sent. In contrast, the fire boundaries mapped by Miller represent areas where previous fire was severe enough to have altered forest composition, age class, or condition. Miller's fires, when labelled, generally date from the 1920's.

The fires mapped under the direction of Harmon had been labelled with fire number and date. Codes were added to these labels to include source of data, fire cause, and size. Fires from the Fire Occurrence Maps and the Miller Map were added to a copy of Harmon's maps (Map 90 Pyle 1983a) and labelled with the same coding system. Table B-6 lists the codes used in labelling the fire map set.

TABLE B-5. Sources and Methods of Information Transfer for Fire Maps

Original Source	Scale	How Information was transferred to Fire Map Set
Narrative fire records	variable	Information plotted based upon sketches in narrative fire records
Fire Occurrence Maps (Maps 91, 92; Pyle, 1983a)	1:62,500	Information copied relative to topographic features shown in common with the 1:24,000 scale maps
Miller Map	1:62,500	Information transferred from overlays described in Table 1 as "MILLER". (See "Boundaries" in this appendix.)

TABLE B-6. Fire Map Codes

Notes:

(1) Information was coded in the following order with each bit of information separated by a dash --
e.g. H-5-1-W6-61

(2) If no information was available, "0" was used
e.g. H-5-0-W7-0

1st Source of data
- H = Harmon
- M = Miller
- F = Fire occurrence maps (1931-39, etc.)

2nd Cause (follows Harmon's fire documentation system)
- 1 = lightning
- 2 = campfire
- 3 = smoking
- 4 = debris burning
- 5 = incendiary
- 6 = equipment use
- 7 = railroad
- 8 = children
- 9 = misc
- 0 = unreported

3rd Size

	Acres	Hectares
1 = Class A	0 - .25	0 - .1
2 = Class B	.26-9.9	.1 - 3.9
3 = Class C	10 - 99.9	4.0 - 40.0
4 = Class D	100 - 299.9	41.0 - 121.0
5 = Class E	300 - 999.9	122.0 - 404
6 = Class F	1000 - 4999.9	405.0 - 2025.0
7 = Class G	5000 or more	2026.0 or more

8 = Class C, D, or E
0 = Unknown size, or not measured

4th Fire Number
Numbers were used as they appeared on maps or if no number was shown, one was assigned. Note that each calendar year numbers start over at 1.

5th Year of fire
Last two digits
or 0 - unknown

Additional information:
- + = Point of origin within fire
- . = Point of origin, no area shown

Red dots = fire scar locations--ignore

APPENDIX C. ANNOTATED GLOSSARY OF DISTURBANCE HISTORY TERMS

Undefined terminology on map legends was one of the most confusing things about the archival maps I worked with in preparation of this report. In the present interpretation of GRSM disturbance history, I have attempted to use a consistent set of terms, both in the discussion and on the overview maps (Figures 1-8, in the main body of this report). The terms are defined below.

area of concentrated settlement- an area where many settlers had buildings and cleared fields.

For purposes of Figure 1, where there were GRSM archival maps showing clusters of homeplaces or cleared areas covering more than half a given area, I labelled it "concentrated settlement." In these areas, the present vegetation can be expected to show unmistakable signs of past clearing. Additionally one expects remnants of cabins, stone walls, old roads, and signs of past fire.

corporate logging- logging operations done under the auspices of corporate ownership of the land.

Tracts of land acquired for corporate owners were large. This led to large scale operations. In a large scale operation, construction of railroads and use of mechanized skidders were economically feasible. With a corporate operation, the wherewithal was available for construction of large modern sawmills which utilized band saws. In contrast to early style methods of logging, more trees were cut in a shorter period of time through corporate logging operations because (1) band saws were faster than circular saws and (2) railroads and mechanized skidders made movement of logs to the mill relatively easy. With the use of railroads and band saws, logs were brought in from greater distances and timber of lower value (size or quality wise) was still profitably cut.

Corporate logging usually resulted in large areas of even-aged regeneration because the majority of the overstory trees were removed in a short period of time. The large scale logging operations left large areas full of logging slash (i.e., limbs and treetops). When this slash dried out it was easily ignited by a spark from a coal fired locomotive. Therefore, severe fires following logging also contributed to even-aged regeneration.

diffuse disturbance- a disturbance for which the boundaries are difficult to define.

Examples of diffuse disturbance can be found at different scales of focus in GRSM. On the broad scale level, a tract of land with 20 isolated farms in 10,000 hectares might be said to have farming impacts diffused throughout. On a finer scale, the impacts of a surface fire rushing through 10 hectares of forest and scorching one tree in a hundred would also be considered diffuse disturbance.

Areas I described as diffusely disturbed generally had a mixture of broad scale and fine scale diffuse disturbance.

discrete disturbance- disturbance with easily defined boundaries.

Examples: a plowed field or a fenced corral surrounded by forest.

early style logging- logging operations done on a local scale.

When logging was done on a local scale, the economics associated with the operation were such that investment in capital intensive equipment was not feasible. Only timber that was easy to get and valuable could be profitably removed. Early style logging took place in GRSM on small tracts of land until the mid-1930s.

Frequently, the effects in the landscape of early style logging are interspersed with those resulting from other uses of the land by settlers.

fire intensity- here is used in reference to the extent of change in the forest canopy caused by a fire. I used "intense" fire in accord with Miller's "burned over" designation: "Areas where fire changed the age class, condition within a type, or changed the type entirely." (See F. H. Miller, 1938. Brief narrative descriptions of the vegetative types in the Great Smoky Mountains National Park. Typewritten manuscript, 10 pp.) On Figure 7, "intense" fire with no further qualification is fire in conjunction with other disturbance. "Intense fire, area showing little recovery in the 1930s" indicates areas Miller found to be burned intensely for which I found no other record of disturbance.

heavy cut- a term found on historic maps in the GRSM Archives (e.g., Maps 38, 50, 51 of Pyle 1983a). The "heavy cut" boundary shown on Map 38 (Miller's Wilderness Overlay) corresponds to the "cut over" line shown on the Miller Map (Map 56 Pyle, 1983a). According to Miller, the cut-over line "was used to show, in a general way, the areas severely culled in the past logging operations." (See F. H. Miller, 1938. "Brief Narrative Descriptions of the Vegetative Types in the Great Smoky Mountains National Park. Typewritten manuscript on file in the GRSM Archives.)

herded livestock grazing- grazing where movement of large numbers of livestock was controlled by herders. Herded livestock grazing should be distinguished from both the fenced pasture typical of heavily settled areas and grazing by free roaming animals in and around settled areas.

The areas shown on Figure 5 are well known areas (of a size large enough to be mapped at the overview scale) to which cattle and other animals were brought annually to graze. In the mapped areas, grazing and associated human activity, such as tree cutting or woods burning,

opened the forest up into grassy areas. The long thin herded livestock grazing area is a grassy bald corridor along the state line ridge.

Herded livestock grazing took place in other parts of the park at lower elevations. There, the different forest types did not retain (or perhaps never had) the openness evident in the grassy bald zone of the park. Where there were accounts of herded livestock grazing not mappable at a fine scale, there were generally other records of disturbance for the same general locale. These accounts and records when taken together formed the basis for designating certain areas as "diffusely disturbed". Certain areas, while having many records of scattered disturbance including widespread but not precisely mappable herded livestock grazing, also have big tree stands. These areas were mapped separately.

light cut- a term found on historic maps in the GRSM Archives (e.g., Maps 38, 50, 51 of Pyle 1983a). Miller (personal communication) used "light cut" to mean that the best trees were taken out of a watershed while trees of lower quality were left.

Areas mapped as "light cut" on GRSM archival maps appear to be of two types: (1) major watersheds in which logging was confined to lower slopes and flats, and (2) noncorporately owned areas adjacent to farming communities which, although not considered "farmland," were not considered "virgin forest".

scale- with reference to maps discussed in this report has two meanings:

(1) representative fraction--physical scale represented by a fraction with "1" in the numerator meaning one unit of measurement on the map is on the ground equal to the number of units given in the denominator. A map may be large scale or small scale. The smaller the value of the fraction, the smaller the scale of the map.

(2) scale of focus --may be broad scale or fine scale. Broad scale maps give an overview while fine scale maps are detailed.

virgin forest attributes- attributes of the ideal virgin forest, a forest in which no direct or indirect effects of people's activities are found. Such attributes may include, but are not limited to, big trees, old trees, and absence of evidence of logging or homesteading.

Since the ideal virgin forest does not exist in GRSM, areas were mapped as "high in virgin forest attributes based upon little or no record of pre-park disturbance". This designation indicates a lack of human disturbance and qualifies the basis on which the label "high in virgin virgin attributes" was used. Maps of GRSM made at the time of Park land acquisition showed large tracts of "virgin" forest. These tracts contained numerous homesteads and areas of early style logging. Much subsequent confusion could have been avoided had they been labelled "high in virgin attributes based upon absence of corporate logging".

APPENDIX D. DOCUMENTATION OF SOURCES USED IN PREPARATION OF FIGURES 1-8

Two major sources of information were used in preparation of Figures 1-8. Both were originally medium scale maps which were repeatedly xeroxed and reduced to the scale shown in Figures D-1 through D-8. The original medium scale maps (Map 38 and Map 50) are described in Pyle 1983a, as are all other maps used in preparation of Figures 1-8. When reference is made in this appendix to Map 38 or Map 50, it should be understood that the reference is to the reduced xerox copies. Due to the fragility of the original Map 50, I made a traced copy of it for xeroxing purposes. In drafting Figures 1-8, I traced lines off the xeroxes of Maps 38 and 50. When I took information from other maps, I filled it in freehand.

Figures D-1 through D-8 in this appendix show the same disturbance history boundaries as Figures 1-8 of the main body of this report. The following discussion will be based on numbered areas and boundary lines on Figures D-1 through D-8. For figures with boundaries in common, individual boundary lines will be discussed only in conjunction with the first figure on which they appear.

Figure D-1. Major Areas of Vegetation Disturbance in Great Smoky Mountains National Park

Area 1. Shown as "light cut" on both Map 38 and Map 50.

Line 1a. This boundary reflects the probable extent of logging up Hesse Creek based on information from Dwight McCarter, GRSM Backcountry Patrol.

Area 2. Shown as "clearcut or farmland" on Map 38.

Area 3. Based on Map 38 and Map 50.

Area 4. Based on boundary of "virgin" and "light cut" areas shown on Maps 38 and 50. O. R. Reagan of Wears Cove says a tram road ran through the "virgin" area and logs were skidded by horse teams. Little River Lumber Co. contracted out this logging.

Area 5. Based on generalization of boundaries of conflictingly depicted areas of "cleared or farmland" shown on Maps 38 and 50 and "grass" or age class "1-20" types shown on Map 56.

Area 6. Based on "heavy cut" shown on Maps 38 and 50. Parts of this area were also logged in the early style prior to logging by the Little River Lumber Co. (Lambert, 1958).

Area 7. Based on "cleared or farmland" shown on Map 38 plus information from Dwight McCarter.

Area 8. Based on a generalized boundary drawn around a conglomeration of "cleared or farmland" and burned "light cut" areas shown on Map 38.

Area 9. Based on "heavy cut" and "light cut" boundaries shown on Map 50.

Line 9a. Maps 38 and 50 show a narrow band of "virgin hardwoods" in this area.

Line 9b. Generalization of "heavy cut" boundary from Map 38.

Line 9c. Based on land ownership of logging company.

Area 10. Based on generalized outlines of conglomerations of "cleared or farmland" shown on Map 38.

Area 11. Based on "heavy cut" or "burned over" boundaries taken from Map 38.

Line 11a. Taken from Map 50 and extended the last 5% to the park boundary.

Line 11b. Based on estimated boundary of spruce prior to logging.

Area 12. Based on a generalized outline of "cleared or farmland" shown on Map 38.

Area 13. Taken from Map 38.

Area 14. Taken from Map 38.

Area 15. Based on a generalizaed outline of conglomerations of "cleared or farmland" shown on Map 38.

Area 16. Based on "heavy cut" and "light cut" areas shown on Map 38.

Area 17. Based on age class 1-20 seen on Map 56 and study of 1982 infrared aerial imagery at Uplands Lab.

Area 18. Based on generalized outline of conglomerations of "cleared or farmland" shown on Maps 38 and 50.

Area 19. Based on areas with buildings shown on Map 85 and "cleared or farmland" on Map 38.

Area 20. Based on age class 1-20 shown on Map 56 and citing by Lambert (1958) of Harrison-Woodbury Lumber Company's logging "as far up (Noland Creek) as Bald Creek."

Area 21. Based on buildings shown on Map 85 and "cleared on farmland" on Map 38.

Area 22. Based on generalized boundaries around buildings and open areas shown on Map 85.

Area 23. Based on cut areas shown on Map 38.

Figure D-2. General vegetation disturbance pattern in Great Smoky Mountains National Park prior to park establishment in 1934.

Area 1. Based on boundary of "light cut" from Map 38.

Area 2. Based on scattered areas of "light cut" and "heavy cut" from Map 38; age class 1-20 and areas burned intensely enough to change species composition, age class or condition taken from Map 56; and homeplaces from Map 60.

Line 2a. Boundary of "cut under 20 years" shown on Map 58.

Area 3. Based on boundary of "light cut" from Map 38.

Area 4. Based on "cut under 20 years" area shown on Map 58 and "cleared or farmland" from Map 38.

Area 5. Based on boundary of "light cut" from Map 38.

Area 6. This area was shown as partly "light cut" and partly "virgin" on Maps 38 and 50. Information from Dwight McCarter, GRSM Backcountry Patrol, suggests it is not without disturbance, but there is no evidence of Little River Lumber Company's railroads in the area.

Area 7. Shown as "light cut" on Maps 38 and 50.

Area 8. Based on boundary of "light cut"/"virgin" shown on Map 50.

Line 8a. Drawn to include both fires that burned intensely enough to alter vegetation composition, age class or condition and age class 1-20 (from Map 56), homeplaces (based on information from Dwight McCarter), and personal observations of areas with evidence of cutting (presumably that done by local loggers and firewood cutters who operated in the area, according to Glenn Cardwell, former resident and GRSM Park Interpreter).

Line 8b. Based on "light cut" boundary on Map 50.

Line 8c. The boundary between diffusely disturbed areas and areas with little or no record of disturbance is hard to place in this area. Map 50 truncates the boundary at this point. Map 38 extends it well to the east. I drew the line shown based on the presence of the spruce-fir type and the absence of fire shown in this area on Map 56.

Area 9. Area of early style logging and salt peter mining operations according to Bill Hooks, former GRSM Interpreter.

Area 10. This area is shown as "light cut" on Map 50 without inclusion of major fires. Lambert's (1958) account of logging in the Big Creek watershed mentions early logging operations which may have reached into this area. Examination of color aerial photos (1979, at Uplands Laboratory) and personal observations indicate some tree removal.

Area 11. The boundaries of this area were arrived at by default. That is, it is an area generally neither high in virgin attributes nor subject to concentrated settlement or corporate logging. The field plot records associated with Map 56 indicate that fires were frequent and diffused throughout the area. These records also mention evidence of early logging. Within the general area, E. L. Trout, Park Historian (personal communication, 1984) has indicated specific areas of livestock grazing. He also pointed out that in an area as heavily populated as Cataloochee (over 1200 people), typical prepark subsistence type farming practices would have depended upon heavy utilization of areas outside concentrated settlement.

Area 12. Boundary developed from boundary of "heavy cut" area shown on Map 50. Lambert (1958) says that only 144 acres were cut by corporate loggers. Map 56 shows some "grass" areas and age class 1-20. I interpreted this information to mean that the drafter of Map 50 felt the area was not "virgin" but was too small to separate out "farmed or cleared areas" and 144 acres of corporate logging and so lumped it with the adjacent "heavy cut" area.

Area 13. Based on "light cut" boundary shown on Map 50.

Area 14. Based on "light cut" boundary shown on Map 50.

Area 15. Based on (1) "fields and woods (culled)" shown on Map 55 outside areas of concentrated settlement and on (2) "culled" areas from Map 55 under non-corporate ownership.

Figure D-3. General vegetation disturbance pattern in Great Smoky Mountains National Park prior to park establishment in 1934 -- including areas of big trees plus diffuse human activity.

Designation of these areas is based in general on personal observation of both disturbed areas and areas of big trees; reports from Dwight McCarter regarding non-corporate logging, homesites and other settler activities; and miscellaneous fires, "grass" areas and age class 1-20 on Map 38. In particular, there was logging for veneer (in Areas 1 and 2) according to Bill Hooks, retired GRSM Interpreter; and mention of logging in prepark lumber land company records in the files of the GRSM Archives (Aluminum Company of America and Morton-Butler Timber Company) for Area 3.

Figure D-4. General vegetation disturbance pattern in Great Smoky Mountains National Park prior to park establishment in 1934 -- including areas of suspected diffuse disturbance.

Area 1. This area (the north side of Sugarlands Mountain) is shown as "virgin" on Map 38. Its proximity to the heavily settled Sugarlands Valley and Lambert's (1958) report of a sawmill on "Sugarland Mountain" lead me to question how high in virgin attributes the area actually is. I made no field investigation.

Area 2. Maps 38 and 50 show this watershed as "light cut". Miller, on Map 38, is known to have used "light cut" to mean the average of heavy cutting along creeks and little or no cutting elsewhere. Testimony by a partner in the Harrison-Woodbury Lumber Company, during the land condemnation (proceedings in GRSM Archives), suggests that the logging in the watershed was somewhat species selective and not geographically extensive. I could find no record of grazing in the upper elevations other than on Andrews Bald.

Figure D-5. General vegetation disturbance pattern in Great Smoky Mountains National Park prior to park establishment in 1934 -- including areas of herded livestock grazing.

Area 1. This is a strip along the state line ridge extending from Parsons Bald to Thunderhead Mountain for which there are numerous accounts (Lindsay 1976) of herded livestock grazing.

Area 2. Based on numerous records of grazing at Silers Bald (Lindsay 1976). Boundary as drawn reflects ownership shown on Map 97 as opposed to actual recorded extent of grazing animal activity. Because of the ownership change and the high elevation, I do not believe the area was corporately logged. I attribute the generally disturbed appearance of the area to extensive and long-term livestock and herder impacts.

Area 3. This area is shown as "cleared or farmland" on Map 50, which was made in the early 1930's. On Map 43 (based on fieldwork done 1900-1901) it is named "Newton Bald" and shown as "cleared." Although no written documentation of herded livestock grazing was found, I included this area because of its consistent appearance in the map record over time as "cleared".

Figure D-6. Severity of corporate logging operations in Great Smoky Mountains National Park. The rationale behind this map is discussed in detail under "Summary of anthropogenic disturbance patterns in GRSM--Corporate logging". Areas not tabulated in Table 3 under this discussion are as follows:

Area 1. Shown as "light cut" on Maps 38 and 50. A tram road is known to have gone through the area and there is extensive second growth along the modern trail which follows the tram road.

Area 2. Shown partially as "light cut" on Map 50 and partially as "virgin" on Map 38. R. S. Lambert says this area was logged with less mechanization and more selectivity than was upper Big Creek (Lambert 1958).

Area 3. Shown as virgin on Map 38 and with a high timber stocking on the TVA ocular type maps (Map 85 of Pyle 1983a). Lambert (1958) cites early style logging in this area.

Figure D-7. Fire.

Area 1. Ayres and Ashe 1905, the plot records associated with Map 38, and oral accounts indicate frequent fire in this area.

Area 2. Presence of charcoal and the high frequency of pines suggest fire as a disturbance. As discussed in the main body of this report (also see Harmon 1981), natural fire frequency will not result in the presence of so much pine. Therefore I interpreted the landscape to indicate presence of frequent fire.

Areas 3-8. Based on Map 38.

Area 9. Based on burned areas shown on Map 50.

Area 10. The plot records associated with Map 38 indicate frequent fire in this area.

Area 11-20. Based on Map 38.

Area 21. Based on written records in GRSM Archives (Condemnation Proceedings: North Carolina Park Commission vs. Montvale Lumber Company.).

Figure D-8. Areas high in virgin forest attributes based upon little or no record of prepark disturbance.

These areas (all of which have been called "virgin" on all the maps I examined) are the areas for which I found little or no record of prepark disturbance. This designation should not be interpreted to mean that the areas are solid blocks of forest wholly lacking in prepark disturbance. Spruce-fir and hardwoods type boundaries are based on Maps 38 and 50.

Area 1. Vegetation type based on field check.

Area 2. Vegetation type based on aerial photo interpretation (color infrared photos dated 6/2/82 on file at Uplands Laboratory, GRSM).

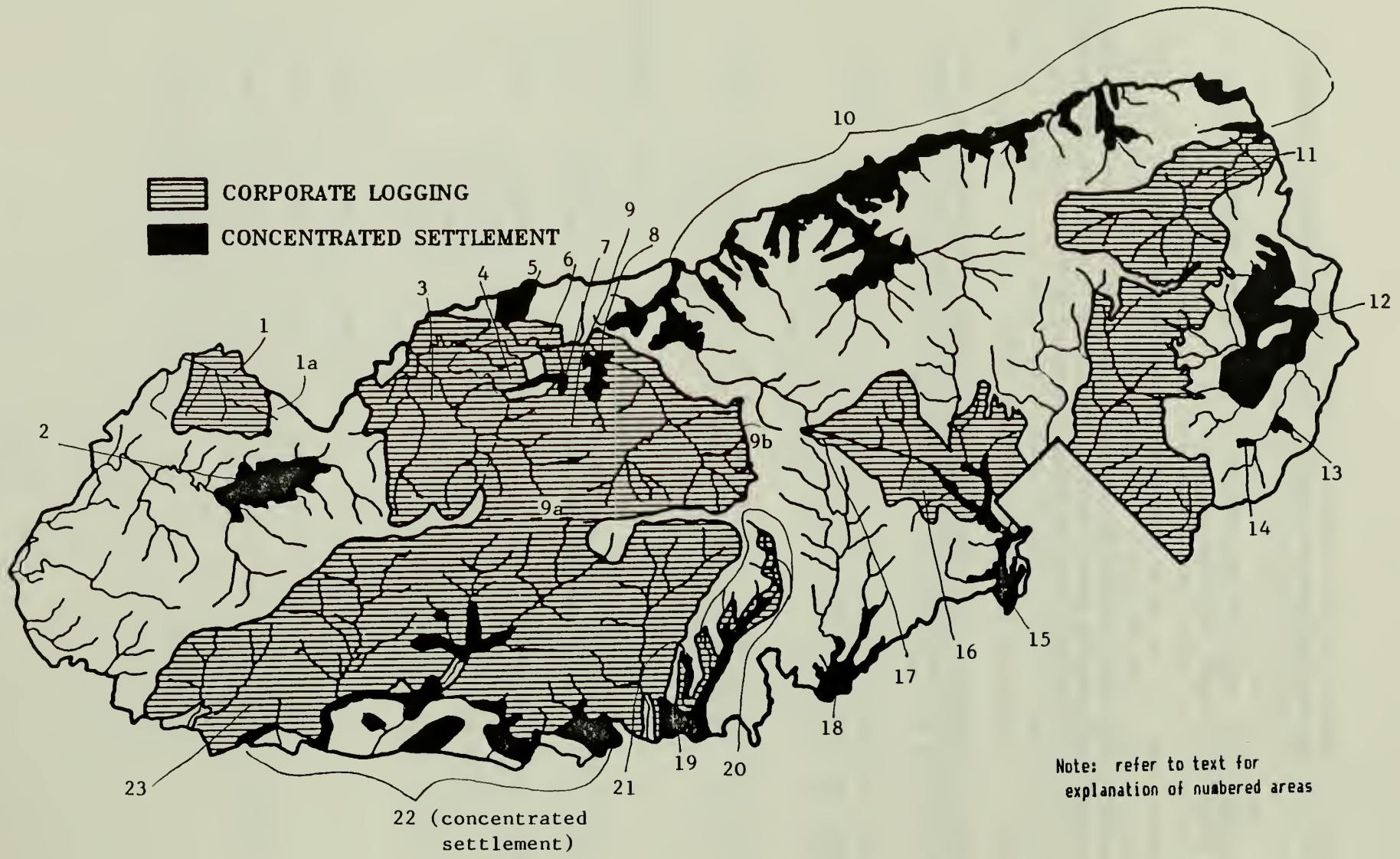

Figure D-1. Major areas of prepark vegetation disturbance in Great Smoky Mountains National Park (GRSM).

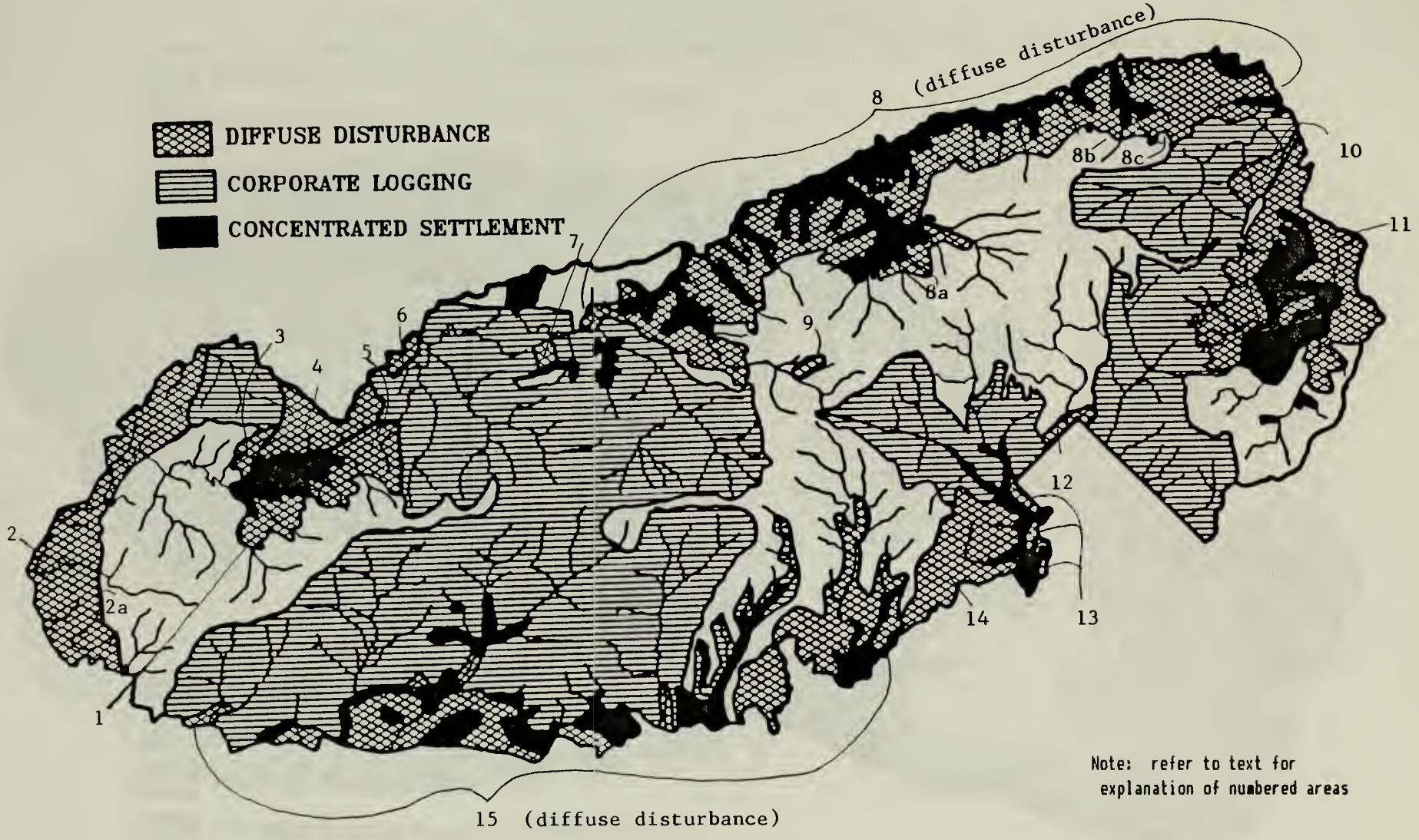

Figure D-2. General GRSM vegetation disturbance pattern prior to park establishment in 1934.

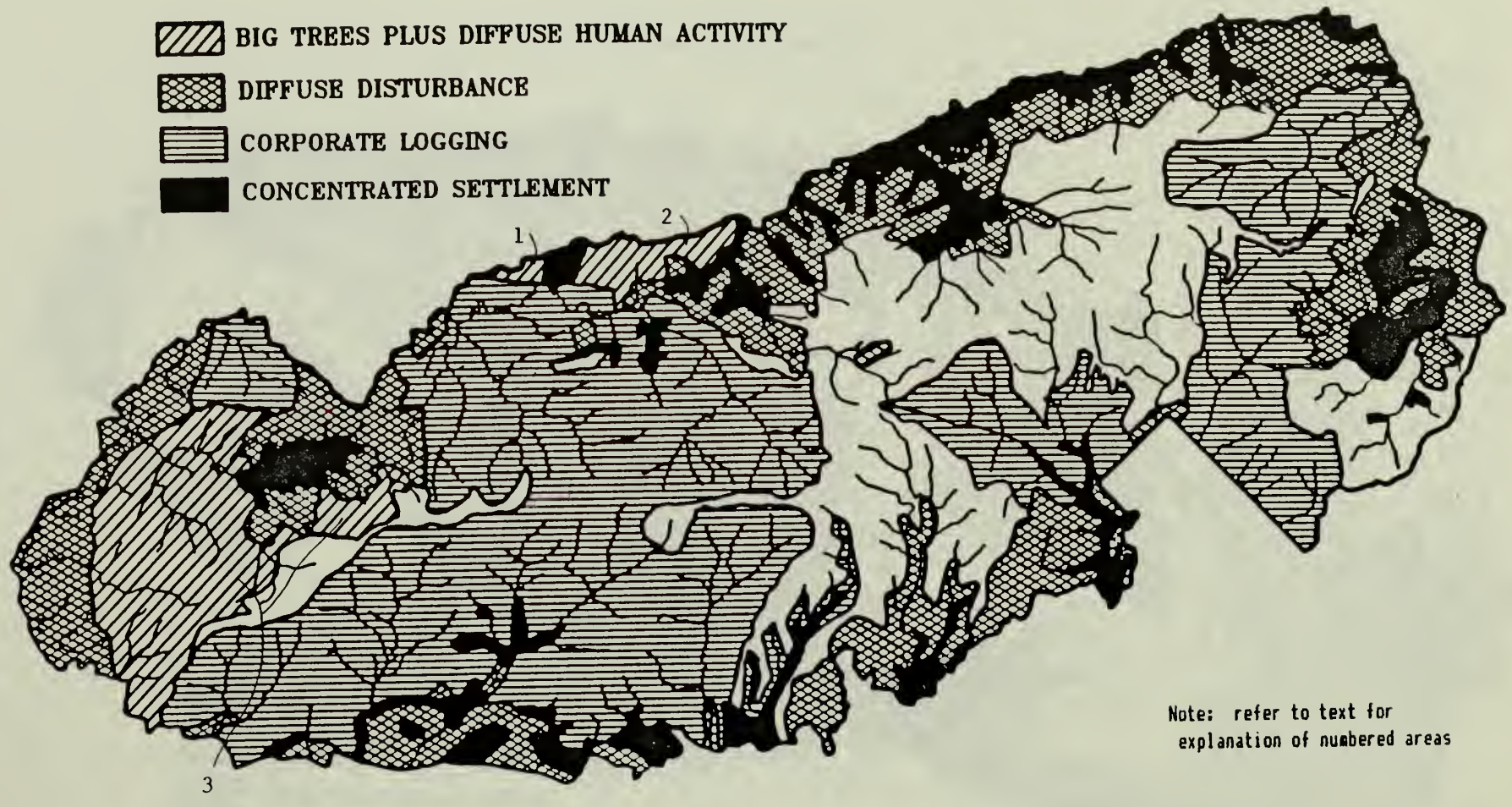

Figure D-3. General GRSM vegetation disturbance pattern prior to park establishment in 1934- including areas of big trees plus diffuse human activity.

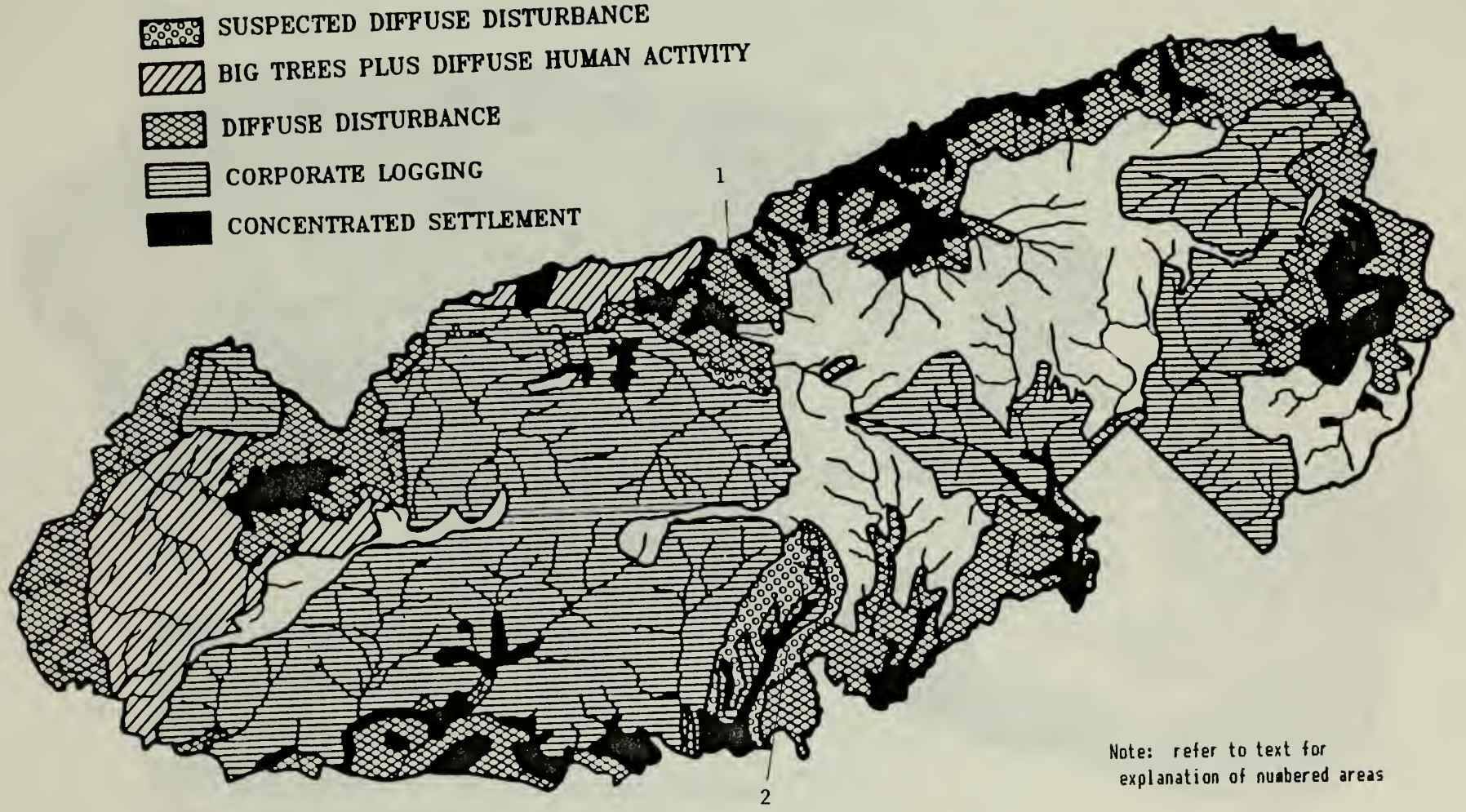

Figure D-4. General GRSM vegetation disturbance pattern prior to park establishment in 1934--including areas of suspected diffuse disturbance.

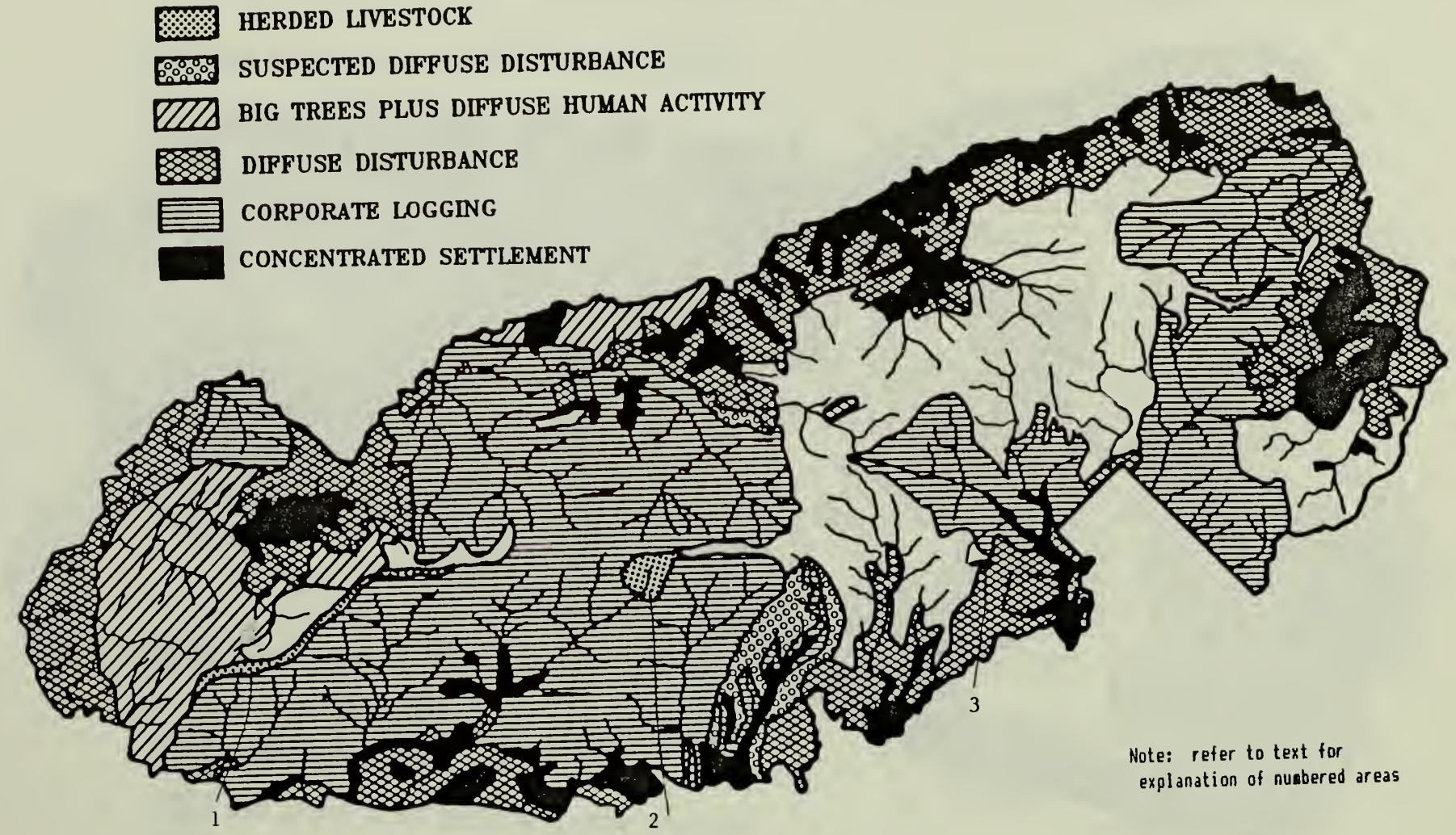

Figure D-5. General GRSM vegetation disturbance pattern prior to park establishment in 1934--including areas of herded livestock grazing.

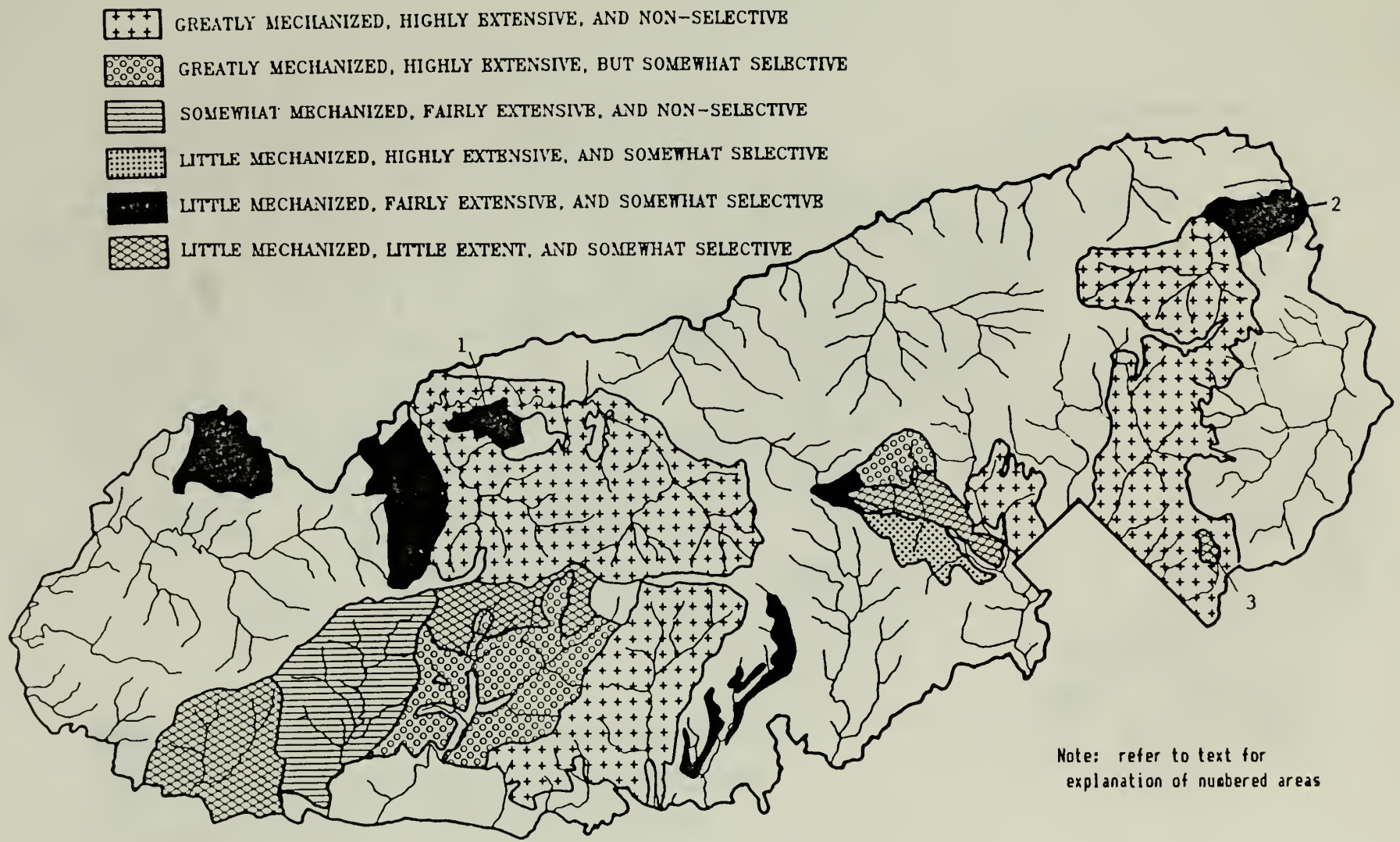

Figure D-6. Severity of prepark corporate logging operations in GRSM.

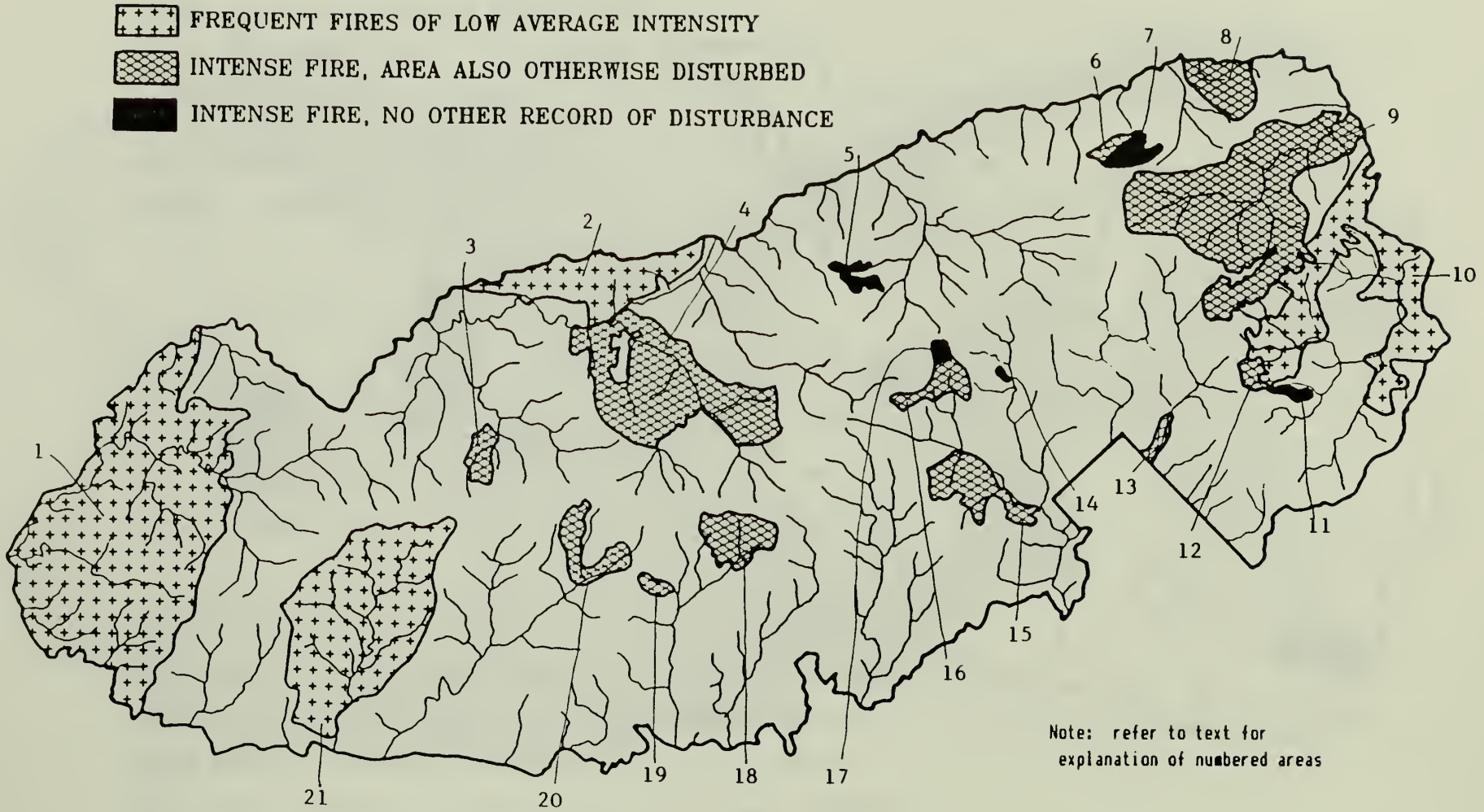

Figure D-7. Location and intensity of prepark fires in GRSM.

Figure D-8. GRSM areas high in virgin forest attributes based upon little or no record of prepark disturbance.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environment and cultural value of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

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